# A Prehistory of Houston and Southeast Texas

*Landscape and Culture*

Dan M. Worrall

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# A Prehistory of Houston and Southeast Texas

## *Landscape and Culture*

Dan M. Worrall

With contributions from John B. Anderson, Cary Burnley,
Don Dobesh, and Rosemary Neyin

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By Dan M. Worrall

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Front and rear covers: Shell necklace and chert knife from the Late Archaic Bowser site (41FB3), Fort Bend County.

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For Teddy, Margaret, and Eleanor

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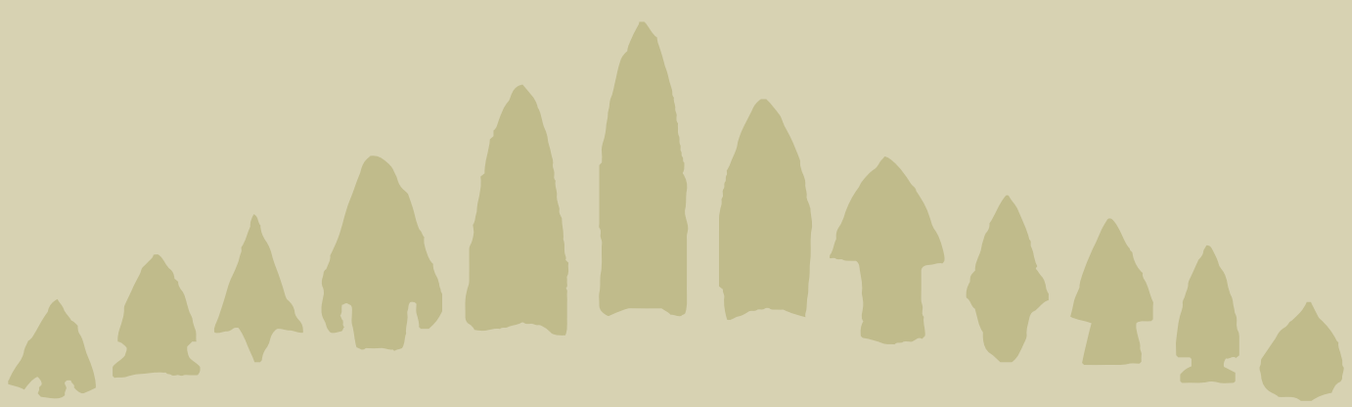


# Preface

Just to the northeast of Greater Houston in the pine forest of the Big Thicket, and to the east in the industrial area of Baytown, live a handful of people with a very rare ancestry. One would not be able to tell their hidden ancestry from their outward appearance or behavior, because they look and act very much like everyone else in the diverse, often mixed-race society of Southeast Texas. But each of them has one or two grandparents or great-grandparents who were Native American Atakapa, a cultural and ethnic group long thought extinct by many academicians. Their forebears were the ancient people of our region, who lived here long before Stephen F. Austin's colonists or the Allen brothers, and long before even the Spanish missionaries who settled on the Trinity River delta. Greater Houston and Southeast Texas are among the oldest continually populated regions in North America, and Native Americans here go at least as far back as the time of Clovis spear points, 13,500 years ago. Archeologic sites just outside this region place Native Americans in the eastern half of Texas even farther back, to as long as 21,000 years ago.

Among these modern Atakapa descendants, those who keep up with family history will tell of grandparents who "went underground" with their ethnic identity, as a result of a long period of Indian hating in early Texas, followed by Jim Crow segregation in the twentieth century. There were never many of them during the early Texian period, because during the preceding Spanish and French era of the eighteenth century their population had been more than decimated by epidemic

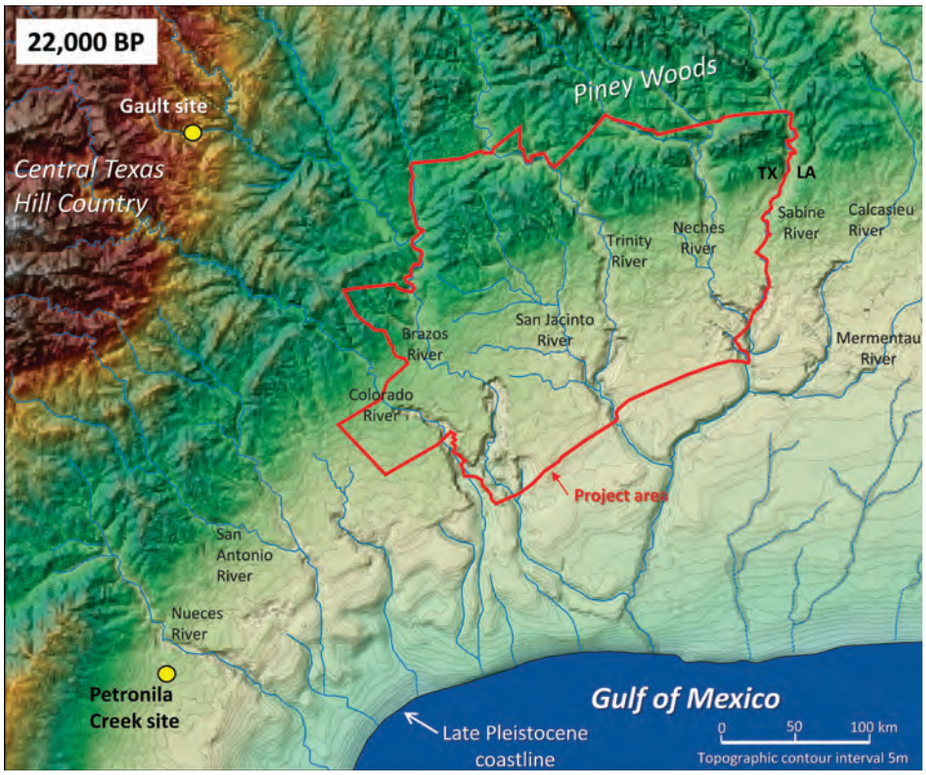
Figure 0.1. A Southeast Texas Native American couple of unknown cultural affinity, ca. 1875. Photographed by Blessing and Brothers photographers, Galveston. Courtesy of DeGolyer Library, Southern Methodist University, Lawrence T. Jones III Texas Photographs.

diseases, a late result of the Columbian Exchange. Lacking sufficient numbers to continue as a cohesive tribal group, those few who were not forcibly deported to Oklahoma during the 1850s disappeared into the Big Thicket, ultimately becoming farmers, fishermen and oil field workers. Some today have Anglo names, and others Cajun French names. Some are African American. All have descended from the intermarriage of their Atakapan grandparents with the local Southeast Texas and Southwest Louisiana population. By the early nineteenth century there were far too few of them left for this to have been any different.

Why should the story of their Native American ancestors in Southeast Texas be of interest to us today? Clearly, the descendants of the Atakapa represent only the tiniest speck of DNA in the enormous diversity that is now Greater Houston. Unlike most Texas cities, the City of Houston has no history of Indian wars, because when the Anglo colonists and their enslaved African American servants first settled along the banks of Buffalo Bayou and the in lower Trinity and San Jacinto river bottoms in the early 1820s, the indigenous Atakapa had already been drastically reduced in number. There were few Indians for the settlers to clear out, unlike the situation of strife between Austin's colonists and the Karankawa farther down the coast or with Comanches in the interior. The very few remaining Atakapan individuals and families were mostly ignored and pushed aside. So what is there to gain by researching the history and prehistory of this smallest fragment of our region's ethnic makeup?

These ancient Southeast Texans lived in a land that was vastly different than that of our time— and one that we of today often do not know very well. Consider for a moment the adjoining two maps (Figure 0.2). The topography of our modern central and upper Texas Gulf Coast environment (upper map) is a familiar and comfortable one, and hardly dramatic. For almost a hundred miles from the coastline inland, there is hardly a rill on the table-flat landscape (the faint contours are at an interval of 5 meters, or about 15 feet). Lazy low-energy rivers and bayous meander across the flat plain, their banks lined with riverine forests of oak, pine, magnolia, and cypress. The vast coastal plain that rests in the flats between these various narrow waterways was once dominated by tallgrass prairie but is now mostly cropland, ranchland, or city. Inland from this plain to the northeast are the red sandy hills of the East Texas Pineywoods, and to the northwest are the rolling Texas plains and savannahs, which stretch to the Central Texas Hill Country. Along the coast, Galveston Bay is like a giant shallow saucer filled with seawater, resting with-

Figure 0.2. Upper: Topography of the present day Southeast Texas project area and surrounding region. Contour interval is 5 meters; the higher country in the Central Texas hills was not contoured. The red outlined area represents the Southeast Texas project area of this report.




Lower: Reconstructed topography of the same area during the Last Glacial Maximum, 22,000 before pressent (BP)W, when sea level was 125 m lower than today. Details of the map's construction are discussed in Chapter 2. Also shown are the locations of the two earliest known human occupations of the region, at the Gault and Petronila Creek archeological sites in Bell and Nueces counties, respectively. Both sites were occupied within a relatively short amount of time after the Last Glacial Maximum.

in the otherwise level and limitless plain. A number of other such bays extend to the southwest. Like Galveston, they bear names bestowed by the Spaniards: Corpus Christi, Copano, San Antonio, Matagorda. To the east in southwestern Louisiana there are no bays open to the ocean, but instead some large brackish water lakes, named by the French: Sabine Lake, Calcasieu Lake, Grand Lake.

However, only the quickest blink of a geological eye earlier—just 22,000 years ago—the landscape was profoundly different (lower map). What we consider Southeast Texas today was perhaps double its size then, with an unimaginably broad and flat coastal plain. Where today one might feast on freshly caught seafood at a Kemah or Seabrook restaurant while overlooking Galveston Bay, that restaurant location in the Late Pleistocene would have overlooked an inland river valley perhaps 100 feet deep or more, with a surging river at its base. To get to your seafood, you would need to walk 140 miles to the coast. This vast exposed plain lay where the Texas offshore continental shelf is today. This map depicts what Texas looked like as the first human occupants entered the region, perhaps 20,000 years ago or more. Two archeological sites that document these earliest Texans, Gault and Petronila Creek, are shown on the lower map and discussed in ensuing chapters.

The climate then was three or four degrees Celsius cooler—allowing much more frequent freezing in the winter—and was quite a bit more humid, yielding a much larger surge of water and river sediments carried in rivers like the Brazos and Colorado. At this time Chicago and Manhattan Island rested beneath a sheet of glacial ice, which reached up to 3 km thick at the peak of the so-called Last Glacial Maximum (LGM). All that trapped ice came at the expense of ocean water, and the resultant lowered sea level (125 m, or 400 feet, lower than today) was responsible for exposing this huge coastal plain.

Leaving this ancient landscape aside for a moment, consider one of the most pressing issues of our present day: global climate change and the ensuing rise of sea level. Current results from tidal gauge analyses and satellite altimetry data provide compelling evidence that the current rate of sea level rise averages ~3.0 mm/yr (Church and White 2011; Rahmstorf et al. 2007; Rignot et al. 2011). Scientists at the National Oceanographic and Atmospheric Administration (NOAA), as part of its Fourth National Climate Assessment of 2017, estimate that sea level could rise as much as 0.3 m to 1.2 m by the end of this century (Sweet et al. 2017). Coupled with this is the effect of land subsidence in the Texas coastal region, induced by a combination of the removal of subsurface water via wells and the natural compaction of our young subsurface sand and mud. This additional effect is as high as 10 mm/yr of apparent sea level rise (Paine 1993; Kolker et al. 2011). Projecting 80 years to the future, relative sea level on the Texas coast could rise as much as 1.1 to 2 meters by the year 2100. Going back to the upper map of Figure 0.2, the first contour nearest the coast is at 5 meters, showing that a narrow part of the coast is clearly in play.

Now consider this from the perspective of an early Native American couple standing on the Texas shoreline 20,000 years ago. They did not know it, but their descendants would face 400 feet of sea level rise in the future that would swallow truly immense amounts of coastal land, with sea level rising at times as much as 40 mm per year—dwarfing anything we face today. They survived and even thrived during this time, as global temperature warmed. One would think that understand-

ing how these early Southeast Texans handled that coastal struggle over many millennia would be of interest to us living in the same place, Greater Houston, in the year 2020, but nearly all histories of the City of Houston reach no farther back than the arrival of the Allen brothers in 1836.

One of the biggest gains to be had by studying prehistory is the sense of long-term perspective that it affords. Hundreds of professional and avocational archeologists have worked for decades trying to understand the vanished ancient people of our area, trying to grasp the ebb and flow of human history over long millennia. The earliest Anglo and African American settlers of Southeast Texas came here only nine generations ago. In just the last four generations, our region's population has experienced explosive growth to more than eight million people. In stark contrast, the ancient ones lived here for *six hundred and fifty generations* at the very least. Their population, as will be discussed below, was likely around four to five thousand people in Southeast Texas at the beginning of the Historic Period. This may not sound like much, and indeed it is but a rounding error compared to our current population. But consider that:

> They managed vast prairies, keeping them open from woody vegetation by means of frequent burning, in order to support their seasonal hunting of bison and deer. They learned to live along river and creek banks with a bounty of aquatic and lowland fauna and flora, and on the bays, harvesting brackish water fish and shellfish. And when their time came to an end, the ecosystems where they lived for those many millennia were still in a healthy state. Theirs was a sustainable, very long-term occupation of the land, and the comparison with our own brief occupation in this regard is stark.
>
> As already mentioned, they coped with rising temperatures and at times a drying climate, as well as constantly rising sea level—often at a far faster a rate of rise than even the most pessimistic predictions of our near future—for millennia, while thriving and slowly growing in population.
>
> On the cultural side, some of these people, living 2,000 years ago in the Lower Brazos region that later was the home of the Coco people, participated in extensive exchange networks that brought them exotic stone ritual items from the Ouachita Mountains of Arkansas and copper ornaments and awls from the Great Lakes, and in return they seem to have sent out ornaments and ceremonial cups made from Gulf Coast lightning whelks. These marine shell items are found not only in their graves along the Brazos but in many graves of that time stretching from the Ouachitas to Ontario.
>
> Meanwhile, the ancients in Southeast Texas developed a language that is distinctly different in words, syntax, and grammar from those of all of their surrounding neighbors. Although they borrowed technology from their neighboring cultures, such as the use of ceramics, and the bow and arrow, they maintained a culture of their own own in a humid, low-country setting that is different from that of any other Texas group.

Clearly, the achievements of these early Southeast Texans are significant. At the time of writing, our civilization is battling a dangerous global pandemic that some analysts estimate may ultimately infect half or more of the global population. More than at any recent time, we may empathize with a people who lost more than 95% of their population to a deadly mix of successive epidemics. Building a greater degree of awareness of these ancient people and their few modern descendants is a goal of this work.

The targeted audience for this work includes anyone in the general public with an interest in our area's distant past. Nonetheless, it is hoped that there is also much in this study that will be of interest to a mix of geologists, archeologists, and historians, because of its broadly multidisciplinary nature. A brief, illustrated summary book for the general reader would have been desirable, but such was unfortunately not possible, because some of the necessary foundational material was not available. First, there were no extant paleogeographic maps showing the development of the physical landscape of Southeast Texas over this period, necessary for an understanding of the natural setting of the early people of this region. Those maps had to be created. Fortunately I had the kind help of several very skilled earth scientists, including Dr. John Anderson at Rice University's Department of Earth, Environmental and Planetary Sciences; a small group of Houston-based geophysicists at the Compagnie Générale de Géophysique (CGG); and Cary Burnley, an expert in Geographic Information System (GIS) mapping technology, retired from Shell Oil Company. Because the paleogeographic maps are new, the technical underpinnings of their creation needed to be included and discussed.

Second, much of the archeological work that defines our region's prehistory is buried in an extensive gray literature of thousands of technical articles written by hundreds of workers, both professional and avocational. There are few summary works for Southeast Texas, notably those of Aten 1983 and Story 1990, but a substantial amount of research in core parts of the Greater Houston area was done after their time, substantially by avocational archeologists of the Houston Archeological Society (HAS). That group's past president, the late Leland Patterson, had worked tirelessly during the late 1980s to put both the results of hundreds of archeological site studies done by HAS and those done by other professional and avocational organizations into a digital database for Southeast Texas, and although he wrote a synthesis paper (Patterson 1996), the data were never displayed and analyzed on maps. The present report takes Patterson's digital data, updates them for the last 25 or so years of new work in the region, and connects them to maps by means of GIS technology, so that aspects of the lives of these ancient people can be displayed through the millennia on paleogeographic maps that reflect the land where they lived. That too is new work that requires some technical discussion. The results allow one's mind to wander over maps that display relationships of artifacts like stone projectile points to past human activites in our region, for example seasonal trips to favored bison hunting sites, or the locations of favored residential sites along the Trinity River. When the element of time is added, one can see patterns of repetition over thousands of years of hunting and fishing, as man interacts with landscape and climate. Mapped patterns of other artifacts give evidence of interactions of this area's former peoples with those of far distant regions.

Because of the need to document these maps and their use, parts of this work are not a light read. My hope is that the inclusion of technical details for some of these items will not deter any interested general reader who is not an archeologist or an earth scientist, and every effort has been made to keep unnecessary technical jargon to a minimum. For my own part, I am a retired regional geologist with no background of any sort in archeology. All this local prehistory and archeological jargon was quite new to me, and it was my curiosity and desire to learn that drew me into the effort. I quickly learned that Wikipedia was my friend for unfamiliar archeological terms and, better still, that the monthly lectures at the Houston Archeological Society were a great way to school myself as well as to meet others who graciously helped me to learn.

No doubt any long-time archeologist, earth scientist, or historian will find some flaws in the result. It is a complex and multifaceted subject, full of intricate facts and overlapping disciplines. Dozens of maps have been created for this volume, and each one is an interpretation of one sort or another. Each line on each map seeks to connect the dots between sometimes widely spaced data points to build a larger understanding. It will surprise no one that other interpretations can easily exist, or that my own work may have missed some data in the voluminous gray literature that might have altered where those lines were drawn. For any and all of those shortcomings, my sincerest apologies. It has been a very enjoyable four years of work, and I hope that you in turn may enjoy the result.

DAN WORRALL
January, 2021

# I.

# Introduction

This study is an attempt to reconstruct physical and human elements of a vanished Southeast Texas landscape, and then to follow that evolving landscape step by step from the time of first known arrivals of humans during the Last Glacial Maximum until the nearly complete disappearance of Native Americans during the Spanish, French, Mexican, and early Texian eras of the late seventeenth through early nineteenth centuries. The maps and interpretations in this volume apply digital Geographic Information System technology to data from coastal geologic studies and to a digital archeological database of the region, illuminating aspects of the region's Late Pleistocene through Holocene natural and human history. In addition, historical accounts of Native American people in the region are reviewed from original documents of the early Historical Period, in order to understand their lifeways better and to enable better interpretations of artifacts found at prehistoric sites. In this chapter I describe the project area and discuss the research methodology, plan of attack, and organization of the results.

## The Southeast Texas landscape

The twenty counties of the Southeast Texas project area are shown in Figure 1.1. This general reference map shows the locations of the major highways and cities. Urban, developed areas are highlighted with gold shading, which defines the Greater Houston developed area, stretching from Conroe in the north to Galveston in the

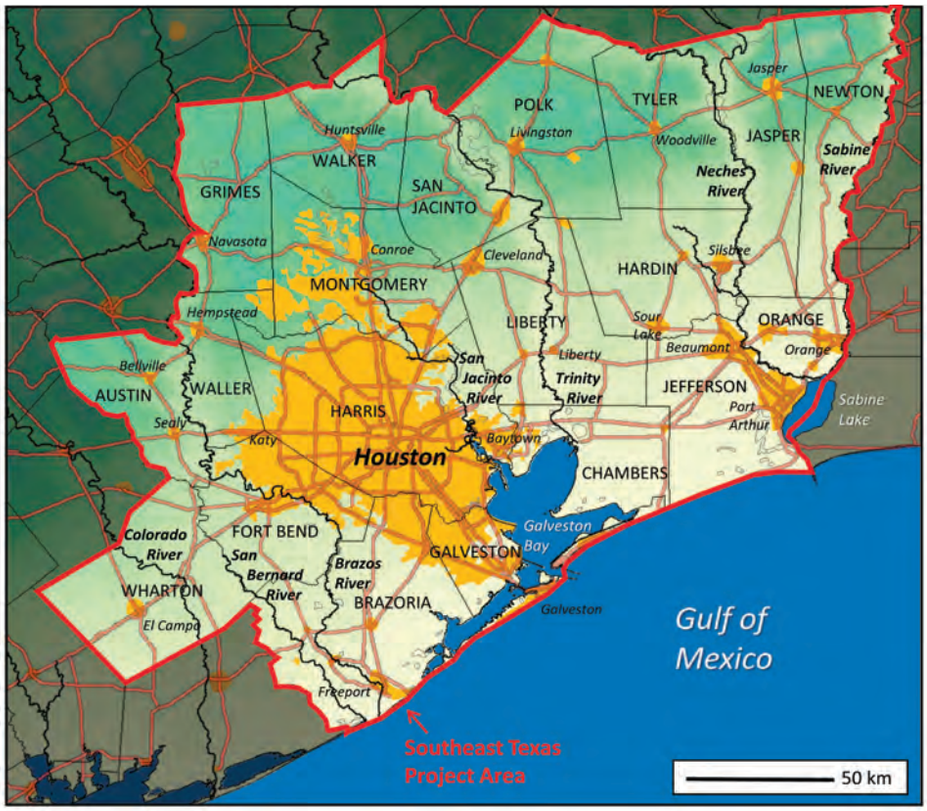



Figure 1.1. Index map of the Southeast Texas project area, including counties, major rivers, and major cities. The main highways are shown in pink, and the current urban developed area is highlighted in gold. The background depicts generalized topography; the darker the green, the higher the elevation.

south, as well as from Katy in the west to Baytown in the east. The only other major urban area is that of Beaumont–Port Arthur–Orange to the east. Wharton County, on the southwest edge of the project area, is not typically considered part of Southeast Texas but is included because of the substantial amount of archeological work done there in the 1980s and 1990s by the Houston Archeological Society, which uncovered the significant prehistory of the San Bernard Prairie and of a unique Late Archaic culture along the lower Brazos River. The San Bernard Prairie work, added to that in the adjacent Katy Prairie in Harris County, added to the understanding of prehistoric prairie hunting in the region by early coastal people, described in Chapter 8.

Southeast Texas includes several ecological landscapes (Figure 1.2). At its south is the great Coastal Prairie, once a seemingly limitless flat expanse of tallgrass prairie extending over 100 km inland from the saltgrass marshes and barrier islands that surround Galveston Bay. Travellers who crossed this prairie in pioneer days noted that their view of the prairie extended unbroken all the way to the horizon, and that the wind billowing across the tall grass reminded them of waves on an endless ocean. To the north was the great pine forest of eastern Texas, which is the westernmost portion of the southern pine forest that extends from the Carolinas to Texas. Prior to extensive logging operations in the early twentieth century, the forest was dominated by longleaf pine, with trunks up to four feet in diameter. Other significant trees include loblolly pine—the version now favored by the logging industry—magnolia, cypress, sweetgum, and hickory. The southern, flat lowland portion of the forest is called the Big Thicket (in Louisiana, the Flatwoods), and in the hilly

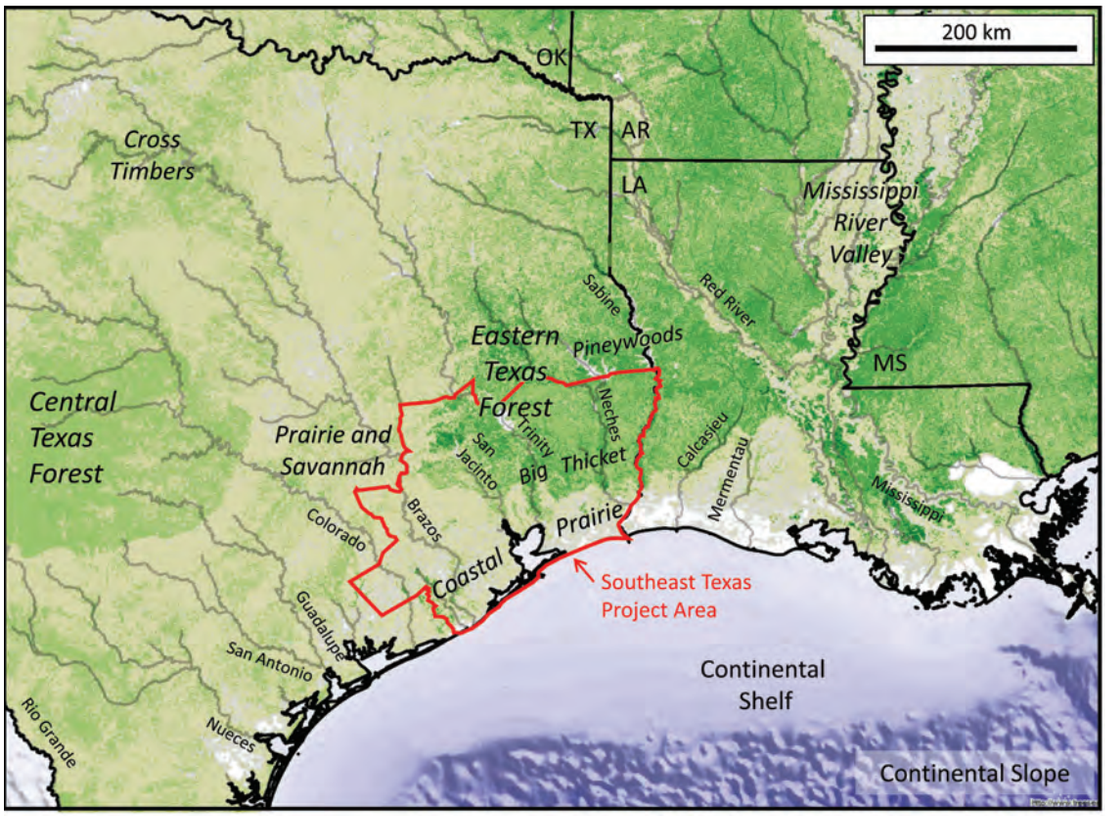



Figure 1.2. Regional vegetation map highlighting areas of modern forests, taken from Wilson and others (2013), U.S. Forest Service. Intensity of shading represents total forest carbon stocks, which correlate in general to intensity of present day forest cover. Green areas represent forests, paler areas represent prairie, and mottled areas are savannahs or (in South Texas) areas of heavy brush.

uplands it is called the Pineywoods.

The map in Figure 1.2 was created by the U.S. Forest Service from satellite data (Wilson et al. 2013), and depicts total "carbon stocks" that consist mostly of woody material. The green areas represent high amounts of carbon, indicating forested land. Paler areas represent prairie, and mottled areas are savannahs or areas of heavy brush. In the upper Sabine River drainage basin in the Pineywoods of northeast Texas, large amounts of trees were removed during the last century and portions of the forest were converted to grazing land, so that portion of the map is not as dark green in color as portions farther south. The westernmost part of Southeast Texas consists of inland prairie and savannah contiguous with the gently rolling Texas plains that lie in the country between the Eastern Texas Forest and the juniper and oak forest of the Central Texas Hill Country.

Of great importance to the ancient residents of our region were the drainage basins of the major rivers (Figure 1.3). In the early Historic Period most southeastern groups were riverine people, living their lives mostly along major rivers, either inland or in their estuaries along the coast. Rivers were the main transportation arteries, allowing for goods and people to travel most easily through forested hilly terrain. The map highlights the drainage basins that surround the main rivers of eastern Texas and Louisiana. Shaded in yellow are the drainage areas of the large river basins of the Mississippi and Red rivers, the Brazos, and the Colorado. These large rivers each stretch deep into the continent, reaching to the sedimentary apron of the Rocky Mountains, and thus they carry large amounts of coarse sand, gravel, and cobbles in their stream beds for most of their lengths. In contrast, the drainage

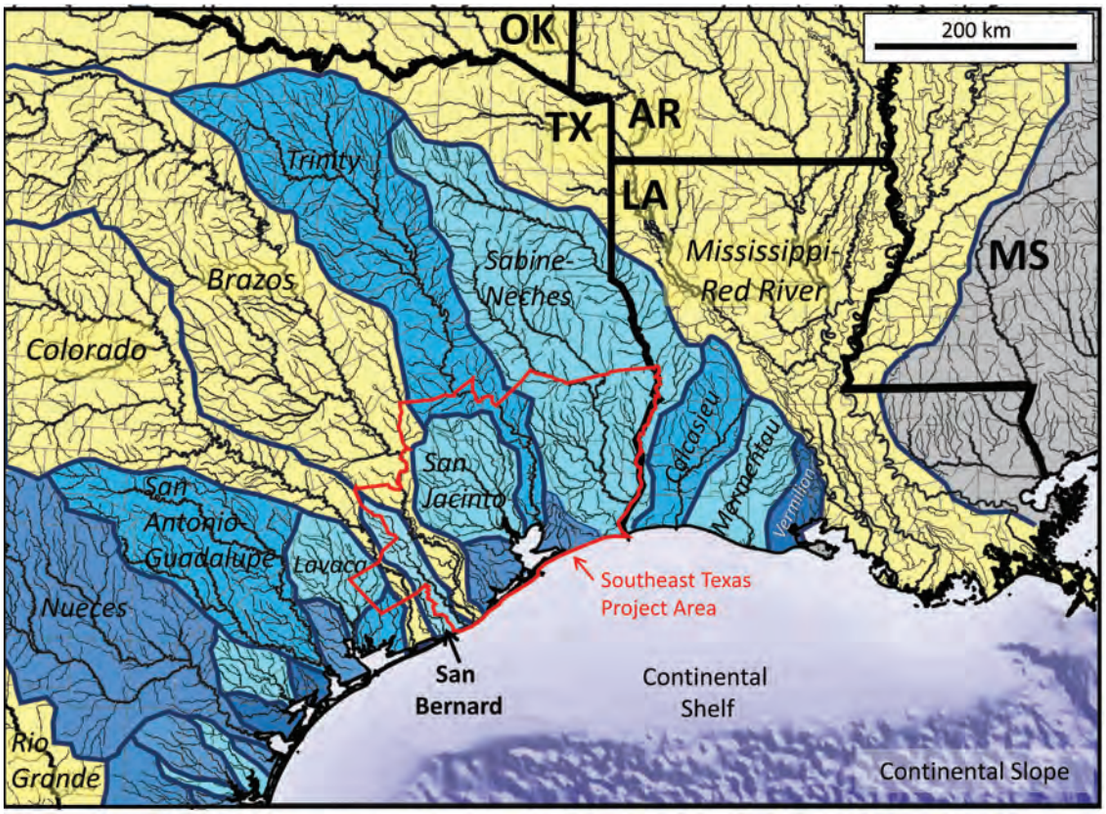



Figure 1.3. Drainage basins of eastern Texas and Louisiana. The Mississippi, Brazos, Colorado, and Rio Grande drainage basins (yellow) dwarf all other drainage basins (blue) in terms of their area and their reach into mountainous source areas of the interior. Red outlining highlights the Southeast Texas project area.

basins shown in various shades of blue are associated with smaller regional rivers; none of these rivers reaches into the mountainous interior. For that reason, they tend to carry finer-grained clastic material (clay, silt, and sand along with lesser amounts of gravel) and tend to be muddy and slow. They have many associated "backwater" small bayous and streams (not shown) in their broad floodplains, well favored by Native Americans for fishing as well as catching turtles and alligators.

During the early Historic Period and probably long before, drainage basins helped define major ethnic boundaries. When observed in the early eighteenth century, the Atakapa lived in the various small drainage basins shaded blue at the center of the map: the San Jacinto and lower Trinity (Akokisa and Bidais); the lower Sabine and Neches rivers (Atakapa proper); and the Calcasieu, Mermentau, and Vermilion basins (the eastern Atakapan bands bore the same names; Swanton 1911, 1952). The focus of the Atakapa in these several small coastal river basins has a deep cultural significance that may relate to the shared geomorphologic development of this group of rivers, as discussed later. The upper Sabine and Neches basins were inhabited by Caddoan people who had only fairly recently moved south into the upper portions of those drainage basins, as discussed in Chapter 11. The very small river basins along the Central Coast were the home of the coastal Karankawa cultural group.

## Methodology and plan of attack

The work is divided into three parts. Part I deals with the development of the phys-

ical landscape, changing geography, and restoring a view of the vegetal landscape as it existed before the European invasion. Part II involves the human history and basic prehistoric lifeways of the region. Part III couples those two parts together to consider the development of human cultures on a changing physical landscape.

Rather than employing a purely chronological approach in reporting the area's prehistory (for example, by starting in the Late Pleistocene and working steadily forward in time), this account is laid out topically, in more or less the same order in which major portions of the compilation and research were done. My hope is that this will afford readers a better understanding of the scope of what is known, what is unknown, and what can reasonably be inferred. This organization of material also allows a fuller appreciation of the careful work and study of the many hundreds of geologists, historians, and archeologists whose research over generations is so briefly summarized in the chapters that follow.

### Part I: Development of the physical landscape

In Chapter 2 data on the extent of sea-level change during periodic global glacial cycles are coupled with geologic and geophysical subsurface data from the Texas coast in order to produce a series of paleogeographic maps of Southeast Texas from the time of the Last Glacial Maximum (about 22,000 years ago) to the present, a period concurrent with the assumed time range of human occupation of the region. The work shown in this chapter was done in collaboration with co-authors John Anderson, Professor of Geology at Rice University; geoscientists Don Dobesh and Rosemary Neyin of Compagnie Générale de Géophysique (CGG), Houston; and GIS expert Cary Burnley (Shell Oil Company, retired).

We begin with the geologic development of the coast during the last full glacial cycle (warm period to cold period to warm period), a cycle that lasted about 130,000 years. At the beginning of that cycle, climate conditions were like those of today and sea level was relatively high. Then followed a long period of cooling temperatures, expanding polar ice caps, and falling global sea level. That process ultimately culminated in the Last Glacial Maximum (LGM) at 22,000 B.P., when the Texas shelf was subaerially exposed. It was during the falling period that a series of so-called "Deweyville terraces" formed along the major rivers of the area; these elevated terraces offered important living sites for early Native Americans, as we shall see in Chapter 6.

The topographic map in the Preface showing the region at the time of the LGM was made using an offshore seismic survey of a geologic erosional surface formed during the widespread subaerial exposure of the shelf during the sea level lowstand of the LGM. Using results of coring studies of coastal bays as well as a finely detailed local sea level curve for the period of rising sea level, it was possible to construct a suite of paleogeographic maps for the period of time during which sea level rose (Atlas I, the first of five such Atlases that are placed at the end of each of the three parts of the manuscript). Those paleogeographic maps show the development of coastal bays and estuaries through time.

The nature of the ecologic landscape (here termed "ecoregions") of Southeast Texas is taken up in Chapter 3. The arrival of Anglo-European settlers and en-

slaved African Americans in the early nineteenth century began a series of significant changes to the vegetal landscape, including the extensive deforestation of large bottomland forests of the Brazos, Colorado, and Trinity rivers for the purpose of establishing cotton plantations. In later years extensive urbanization has substantially altered many ecoregions in the Greater Houston and Beaumont–Port Arthur areas. A map of Southeast Texas ecoregions restored to the time when the first Spanish and French visitors arrived at the beginning of the Historic Period has been prepared. The effects of human presence on the Southeast Texas vegetal landscape did not begin with European settlement, however. A brief ethnohistorical review of the effects of early Native American occupants on the landscape—especially regarding the use of fire—underscores the fact that early Spanish soldiers and missionaries did not walk into a primeval landscape but one that had long been adapted to human presence.

Was the Southeast Texas vegetal landscape significantly different during the LGM, presumably when Native Americans first arrived? Understanding the distribution of forested versus grassland areas in the Late Pleistocene, when temperatures were a few degrees cooler and the climate somewhat wetter, is not well understood, partly because fossil pollen data are typically not well preserved in humid Southeast Texas soils (Bryant and Holloway 1985). In Chapter 3 this question is addressed from another direction, using the distribution of fossil remains of the once abundant Late Pleistocene megafauna (mammoths, mastodons, sloths, camels, and the like) in Southeast Texas. A compilation of about 50 area fossil localities from the time of the last glacial cycle gives a crude picture of where grassland grazers—as opposed to forest and savannah browsers—lived. This Late Pleistocene faunal distribution, when compared with the early Historic Period distribution of vegetation zones, gives a useful but tenuous estimate of the distribution of main vegetation zones of earlier landscapes.

### Part II: Development of the human landscape

Part II relates early Native Americans to this landscape, using ethnohistorical and archeological data.

A review and compilation of ethnohistorical documents relating to the lifeways of Native Americans in the early Historic Period is presented in Chapter 4. These Southeast Texas ethnic groups of the early Historical Period (including the Akokisa, Bidai and Atakapa bands of the Atakapa cultural group, and the Coco band of the Karankawa) have all but completely vanished. Archeological data are a primary source of information on their prehistory, but the nature of much of the record is relatively sketchy, consisting in most sites only of lithic points and tools, a few hearths, and scant faunal remains. The historical record of first-hand observations of these Native Americans during the sixteenth through early nineteenth centuries is essential to help fill out our understanding of how hunter-gatherer people lived in this coastal plain environment—how they hunted and fished, what they ate, how they moved about the land during the four seasons, and how they were organized. This information comes from a mixture of historical accounts (written during the Spanish, French, and early Texas eras), and a few ethnological studies from the early

20th century, when some of the last few survivors were interviewed by ethnologists from the Bureau of American Ethnology. The information is seemingly voluminous and detailed (and the chapter is admittedly extended), but it gives us many key insights that are not obtainable any other way.

Chapter 5 consists of a review of the digital archeological data used in the project. It includes locational data on such topics as types of lithic points and tools, styles of ceramics, presence of bone and shell tools, types of faunal remains, descriptions of aspects of human burials, radiocarbon dates, and interpretations of archeological periods represencted at each site. These data were first collected and organized by Leland Patterson of the Houston Archeological Society in the 1980s, and were gathered from site reports of studies made by the HAS and other professional and avocational archeologists. After a synthesis of Southeast Texas prehistory by Patterson in 1996, that digital database was nearly lost and all but forgotten. As part of the present project, it has been digitally refreshed with newer software, updated with the results of HAS and other reports from 1996 to 2019, and placed within a digital GIS (Geographic Information System) to relate the data to geographic locations and then to regional scale maps. Many patterns emerge from these maps that are not evident from individual site-based reports, such as concentrations of sites in various lifeway zones, patterns at cultural boundaries, and the like. As part of this analysis, the potential for geographical sampling bias from a variety of factors is also considered.

Chapters 6 and 8 define and analyze three important "lifeway zones" that reflect basic living patterns of prehistoric Southeast Texas inhabitants. These lifeway zones are based upon analysis of the locational clustering of archeological sites in various ecoregions outlined in Chapter 3. Chapter 6 considers a coastal zone lifeway, exemplified by the appearance of marine shell middens as well as artifacts associated with coastal fishing and hunting. It also considers a second lifeway related to the occupation of inland river valleys, as exemplified by archeological (and historical) site locations close to those rivers; by faunal remains of large amounts of fish, turtles, and alligators; and by evidence of the construction and use of dugout boats.

Chapters 7 and 8 take up the lifeways of the inland prairies. In Chapter 7 the lithic traditions of projectile points are analyzed geographically across the eastern half of Texas, in order to pinpoint who was hunting in the prairie areas of Southeast Texas, and where they came from. Chapter 8 considers archeological sites and lifeways of Native Americans in the Katy and San Bernard prairies, which were locales for bison and deer hunting in precisely focused zones from at least the Early Paleoindian Period, continuing into the Historic Period. There are four primary local areas where this hunting occurred: in the Katy Prairie, at specific portions of Cypress Creek, White Oak Bayou, and westernmost Buffalo Bayou; and in the San Bernard prairie, at the intersection of the San Bernard River and West Bernard Creek. These appear to be recurrent kill zones defined by numerous multicomponent archeological sites, where hunters seem to have driven large animals into narrow creeks with steep banks, allowing the bison and deer to be more easily killed with atlatls. Artifacts at adjacent campsites are consistent with butchering and cooking of prey. Chronological and geographic analyses of projectile points (Chapter 7) show that sites in these two prairies were used at alternate times over millennia by hunters

coming from central Texas (a "Central Texas Balcones Tradition"); hunters coming from habitation sites along the forested banks of the Trinity and San Jacinto rivers and the Sabine and Neches rivers (the "Trinity-Sabine Tradition") with its adjacent coastal zone; and by South Texas hunters from the central coast ("Central Coast-South Texas Tradition"). During the early Historic Period, Atakapan hunters of the Akokisa and Bidai bands (Atakapa) living along the San Jacinto and Trinity rivers as well as Coco band (Karankawa) hunters migrated from their principal habitations near the coast to these adjacent inland prairies to hunt bison that migrated seasonally into the Katy–San Bernard prairie areas from the Texas plains in late fall and early winter months. The bison made their way toward the coast searching for green grass as frost caused inland grasses to go dormant for the winter.

Lithic resources—the primary source materials for various parts of the Native American toolkit—are analyzed in Chapter 9. Hunter-gatherers of this region were keenly dependent upon lithic material for projectile points, knives, scrapers, and other tools of daily life. Where rock material was not available, such as along the coast, shell and bone material provided alternatives. Native Americans also were users of red ochre and asphalt for various other tasks and events of daily life. The lithic resource potential of various portions of the underlying geologic substrate of the region has been analyzed and compared with mapped distributions at archeological sites of lithic production materials (cobbles, cores, flakes), of various lithic tools, and of other earth-derived materials like sandstone, red ochre, and asphalt.

### Part III: Putting it all together

In Chapter 10 the human occupation through time of the three main lifeway zones is studied from the vantage point of paleogeography (Atlas IV). The effect of sea level change on the earliest cultures is difficult to assess, because expected coastal occupation sites of Paleoindian and Early Archaic time now lie beneath the water of the continental shelf. As a result, nearly all the observed earliest sites of this region are inland hunting and fishing sites. However, an understanding of lifeway zones in relatively young coastal area sites can be used to project lifeway patterns onto paleogeographic reconstructions of now submerged areas, and resulting observed and projected patterns can be viewed through time. It can probably be assumed that the sharp geographic focusing of observed coastal and inland archeological sites into the three simple lifeway zones—one utilizing the rich resources of fishing and shell-fishing in coastal bays and inlets, a second involving fishing and hunting along interior rivers, and a third consisting of bison and deer hunting zones in interior prairies—extended into now offshore areas, providing a first-pass model for future archeological exploration of these submerged areas.

The river drainage basins of the areas that were inhabited during the early Historic Period by the six main bands of the Atakapa—the San Jacinto, Trinity, Sabine-Neches, Calcasieu, Mermentau, and Vermilion rivers, inhabited by the Akokisa, Bidai, Atakapa proper, Calcasieu, Mermentau/Opelousas, and Vermilion bands—are all branches of what was once one large paleo-Sabine river system, as the maps of Atlas I demonstrate. The shared trunk of that system was submerged in Archaic time by rising sea level. The dialects spoken by the Atakapan bands that

resided on the various separate drainage basins of the paleo-Sabine river system were closely linked linguistically, suggesting that the larger Atakapa cultural group originated along that shared, now submerged trunk and its coastal outlet. There is a sharp linguistic contrast between the Atakapan language and that of all surrounding groups, which inhabit separate, other drainage basins.

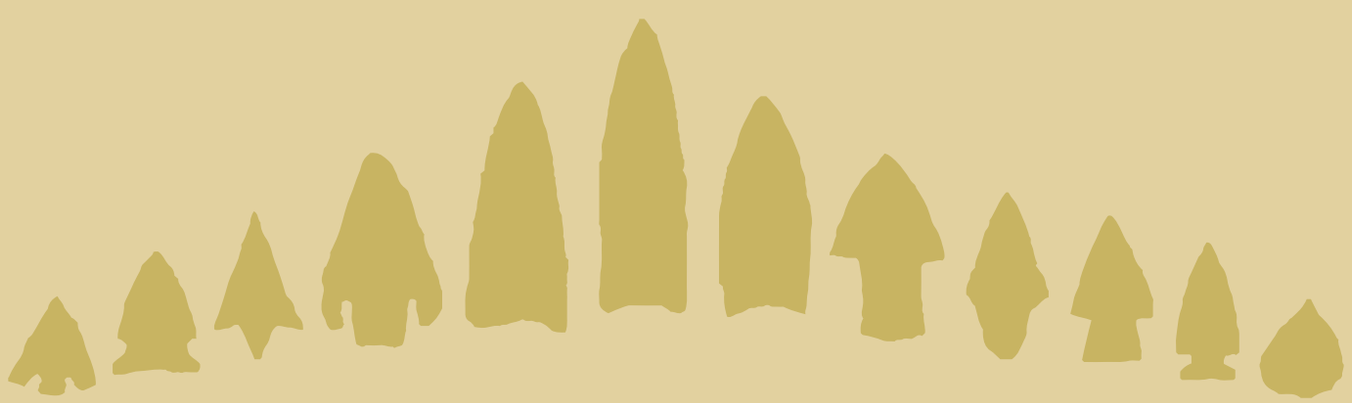
The Late Archaic, Early Ceramic, and Late Prehistoric Periods brought enormous technological change to this region, much of it originating in the Upper and Lower Mississippi Valley; these cultural changes and exchanges are explored in Chapter 11. A Late Archaic culture along the lower Brazos and Colorado rivers participated in a regional exchange system that brought exotic ornamental stone gorgets and (probably) ritually used boatstones and from the Ouachita Mountains of Arkansas and eastern Oklahoma, as well as copper items from the Great Lakes. These Brazos and Colorado people buried their dead with those exotic items as grave goods, along with pendants and round gorgets made of marine shell lightning whelks (*Busycon perversum*) that seem to have been produced locally. Very similar Late Archaic and younger *Busycon* pendants and gorgets are found in the burials in the Wister and Fourche Maline cultures of Arkansas and Oklahoma, and of the Glacial Kames and Adena cultures of Ontario and the Ohio River Valley, suggesting elements of reciprocal regional exchange.

The dispersion of ceramic technology from the Lower Mississippi Valley to people of the Trinity-Sabine Tradition living along the rim of Galveston Bay occurred by AD 100, and that technologic dispersion continued, reaching outlying areas of the Central Texas-Balcones and Central Coast-South Texas traditions a few centuries later. The ceramics used by people in the Southeast Texas region define what has been termed the "Mossy Grove culture" within what was, during the early Historic Period, the land of the western Atakapa. Correlation of this culture with eastern extensions of proto-Atakapan culture in southwestern Louisiana is made difficult by different classification systems for ceramic types in use on either side of the modern Sabine River.

Finally, Chapter 12 is an epilogue that briefly compares certain aspects of Southeast Texas Native American culture—in particular the apparent great longevity of Atakapan culture, its small population, its resilience in the face of climate change and sea level rise, and its sustainable use of the natural environment—with those of our own modern day culture.

A fire on the Katy Prairie.
Woodcut by Barbara Whitehead.

# Part I
# The Physical Landscape



# 2.

# Development of the coastal landscape during the last glacial cycle

Dan M. Worrall, John B. Anderson, Don Dobesh, Rosemary Neyin, and Cary Burnley

The Texas continental shelf is a very broad, relatively flat expanse of shallow water today (Figure 2.1). About 140 miles wide at its widest, only western Florida has a wider shelf along the northern Gulf Coast. At the time of the Last Glacial Maximum (LGM) during the Late Pleistocene, which occurred during a cold time of maximum coverage of polar ice sheets between 26,500 and 19,000 years ago (Clark et al. 2009; usually cited at its maximum at ca. 22,000 BP), sea level was 125 m lower in elevation than it is today, and this broad expanse of continental shelf was completely exposed (United States Geological Survey 2012). At this time, inland rivers and streams cut deeply into (incised) the coastal plain, leaving floodplain valleys and stream gullies that still can be seen in the landscape. The climate was wetter and perhaps three to four degrees cooler than today (Shakun et al. 2012), and this exposed shelf was the home of prairie and forest, of mammoths, mastodons, giant sloths, camels, horses, and saber-toothed cats (Chapter 3).

The great sea-level lowstand that formed the exposed shelf was related to the expansion of the polar ice caps during a period of cooler global weather: large amounts of water trapped as glacial ice at the poles resulted in lower sea level. As weather warmed after the LGM and the global ice caps began to melt, sea level rose, and these wide, subaerially exposed coastal lowlands were systematically flooded. That warming and its consequent rise in global sea level has continued to the present day.

The physical development of the landscape greatly impacted the development

of prehistoric human culture. The goal of the present chapter is to present a series of paleogeographic maps that provide a physical landscape context for various Native American archeological sites in Southeast Texas from the LGM to the present. Using the results of previous geologic studies of the Texas coastal zone—including coring transects of Texas and southwest Louisiana bays, geophysical mapping of an offshore regional erosional surface that was produced during the LGM, and locally calibrated sea level curves—a set of sequential paleogeographic maps of the Texas coast since the LGM has been produced. GIS and 3D seismic workstation technology were used to model the successive drowning of the 22,000 BP surface, integrating sea level curves and the bay core studies to chart the geographic impact of riverine and deltaic sedimentation on both coastal bays and the modern offshore continental shelf. In Chapter 10 of this report these paleogeographic maps are coupled with information compiled from archeological sites to summarize human development at a time of rapid geologic change.

## Early Americans in a time of rapidly changing physical landscape

The period in which the Texas coast was rapidly and dramatically evolving was coincident with the arrival of humankind in Southeast Texas. Current archeological thought holds that early Americans came from eastern Siberia and crossed into Beringia (the currently submerged Bering shelf) during or near the LGM, although yet earlier arrivals are not precluded. As climate warmed, groups migrated south and east, perhaps by island hopping along the Pacific coast of North America (Graf and Buvit 2017). By at least 16,000 BP, and possibly as early as 21,700 BP, these Native Americans were in central Texas, according to recent optical scanning luminescence age dates at the adjacent Gault and Friedkin archeological sites in Bell County (Figure 2.1; Williams et al. 2018; Waters et al. 2018). These and other such ancient sites in North America have, in recent years, displaced an earlier school of thought that held that the first inhabitants of the Americas were people who participated in the Clovis material culture (e.g., Suárez and Ardelean 2019). At the Gault and Friedkin sites, Clovis material culture is dated by Williams, Waters and others

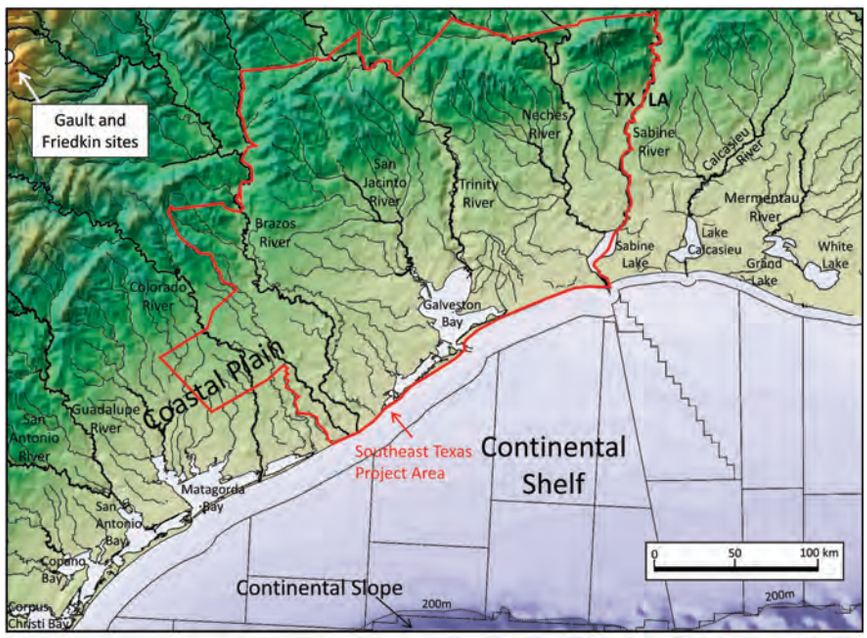



Figure 2.1. Index map of Texas coastal plain and adjacent continental shelf. This map depicts the area cov-ered in the paleogeographic maps of this chapter. Offshore boundaries are survey areas of the Bureau of Ocean Energy Management, Department of the Interior, shown for reference.

at 11,900 to 13,500 BP (Williams et al. 2018; Waters et al. 2018). The older period of occupation—evidenced by the older material culture that rests stratigraphically beneath Clovis artifacts at Gault—is now termed the Upper Paleolithic (Williams and Madsen 2019). Material ascribed to the Upper Paleolithic Period has also been found along the Aucilla River in northwest coastal Florida (Halligan et al. 2016). Although pre-Clovis materials have not yet been identified in Southeast Texas, their occurrence both to the west (Gault, central Texas) and to the east (Page-Ladson, Florida Gulf Coast) indicates a strong possibility of the arrival of humans in Southeast Texas by the Upper Paleolithic, but the earliest artifacts yet found in this region are Clovis (Chapter 10).

As these people entered the area, they used the evolving Late Pleistocene and Early Holocene landscape to their advantage. In the floodplains of incised river valleys, a series of cut-and-fill episodes related to minor oscillations in sea level fall created river terraces that were preferred by Native Americans as campsites along the Trinity and other rivers. As coastal portions of these river valleys were flooded by rising seas after the LGM, shallow water bays formed over the old valleys, of which Galveston Bay is an example. These bays were and are rich with brackish water fauna much utilized by Native Americans (Chapter 6). Early bays were located in the now submerged offshore shelf, and were successively flooded, pushing the coastline landward. Along small inland streams and bayous that transect the coastal prairies, the oscillations in sea level that preceded the LGM produced steep gully-like stream walls that reached 2 to over 10 m in height in some areas. Some of these gullies became bison kill sites that were used repeatedly by Native Americans over millennia (Chapter 8).

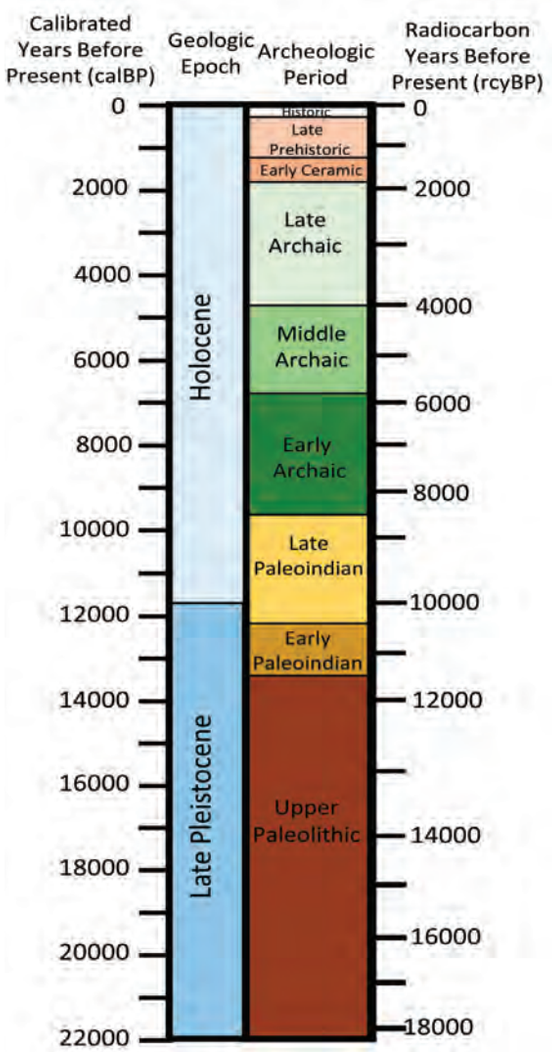



Figure 2.2. A Southeast Texas chronology for the period of time following the Last Glacial Maximum. Ages are shown in calibrated years before present (calBP) on the left, and in radiocarbon years before present (rcyBP) on the right. This report employs calendar years (calBP or simply BP) through-out unless otherwise noted. A geological column includes the end of the Late Pleistocene Epoch, with the Holocene Epoch ensuing after 11,650 calBP. Archeological Periods mirror typical usage in Southeast Texas; see Chapter 5 for further discussion.

## A note on relative and absolute time scales employed in this report

A time scale for the last 22,000 years since the LGM is shown in Figure 2.2. It combines both elements of relative time (geologic epochs and archeological periods) and absolute time (radiocarbon years and calibrated years before present). In geologic nomenclature, the strata considered in this report lie in the Late Pleistocene and Holocene Epochs of the Quaternary Period. The Pleistocene stretches from about 2.58 million years BP to about 11,650 BP. The LGM (22,000 BP) occurred near the very end of the Pleistocene.

The sequence of archeological periods shown in Figure 2.2 reflects the typical sequence of periods of Native American cultural development used by archeologists to describe sites in most of eastern North America (e.g., Willey and Phillips 1957). The Southeast Texas variant of this relative archeological time scale has been modified and updated somewhat from that prepared by Leland Patterson (1996), in particular reflecting the advances in our understanding of the earliest arrivals of humans to Texas. The period called Upper Paleolithic was adopted by Williams and Madsen

(2019) to reflect the people who arrived in Texas and North America before the development of Clovis tools, whose story is only recently emerging from archeological work at the Gault and Friedkin sites of central Texas and a handful of other places (Waters et al. 2018; Williams et al. 2018). The Early Paleoindian period refers to a period of broad-spectrum subsistence (and big game hunting) of relatively mobile groups, principally by people of the Clovis and Folsom material cultures. The Late Paleoindian period saw hunter-gatherer population growth and an increase in a more sedentary and geographically focused lifestyle; the San Patrice culture of eastern Texas, Louisiana, and Arkansas is a good example (Jennings 2008). The long Archaic period saw pronounced population growth and the further development of distinct cultural territories. The Early Ceramic period refers to a time when pottery technology was locally adopted, and the Late Prehistoric Period in Southeast Texas marks the time of adoption of the bow and arrow, ca. 1300 BP (Ricklis 2004). The absolute time boundaries between these periods vary from region to region. For example, pottery was adopted by Mississippi Valley cultures long before it reached the Texas Karankawa (Chapter 11).

The temporal boundaries among these relative time periods are measured in absolute time in years before present. Ideally, one would wish a system that counted years as complete rotations of the sun around the earth—calendar years. For a brief time after the adoption of radiometric dating techniques in the 1950s, it was assumed that radiocarbon years (marked on the right edge of the chart) had the same duration as calendar years. However, it was soon recognized that there was a divergence between the two that increased with advancing age before present, due to the fact that the isotopic ratio $^{14}C/^{12}C$ used in radiometric dating has not been constant in the atmosphere through time (Taylor 1987). A number of calibration curves have been developed to calibrate radiocarbon years before present (rcyBP) to calendar years before present BP; the calibrated years shown at the left edge of Figure 2.2 employ a calibration that relies on the INTCAL13 effort of 2013 (Reimer et al. 2013). The resulting calibrated years before present (calBP) column is thought to be the equivalent of calendar (solar) years. In this report all further dates are given as calibrated years before present (calBP), unless otherwise specified, and the abbreviation calBP is typically abbreviated simply BP.

In recent years a new form of dating has gained usage in archeological circles for late Quaternary materials (Rhodes 2011). Measurements of optically stimulated luminescence (OSL) on mineral surfaces have been utilized by archeologists to date the last exposure to sunlight of excavated sand grains, or the last heating of ceramics. Archeologists at the Gault site in central Texas have utilized this new technique extensively (Williams et al. 2018). These dates are estimated to be close to calibrated years and are typically reported as ka (thousand annum) before present.

Historians, who deal with a shorter time scale than archeologists, typically measure time in years before (BC) and after (AD) the birth of Christ. We will use this system only for dates referring to the Historic Period, which in Southeast Texas begins with the arrival of Europeans. Although Cabeza de Vaca famously visited the Texas coast in AD 1528, the onset of continued European presence dates approximately to La Salle's failed colony in AD 1688 and the prolonged Spanish reaction to it. For such dates of the European period, we dispense with the AD and simply

report 1688.

## Glacial events, sea level change, and the evolution of the Texas coast

For many millions of years, the earth's temperature has been oscillating from cold to warm on a time scale far grander than mere years. The maps of Figure 2.3 portray the northern hemisphere at the last two extremes of this oscillation: at the Last Glacial Maximum at about 22,000 BP, when vast amounts of glacial and sea ice were stored in the northern and southern polar ice caps, and at the interglacial warm period of today, when much of that ice has melted, yielding higher sea level. Ice cores from the Russian Vostok station in Antarctica (Petit et al. 1999) detail these periodic oscillations—which result from changing global temperature—over a 400,000-year period, using the deuterium content of ice as a proxy for paleo-temperature (Figure 2.4, top). The fractionation of the oxygen isotope $O^{18}$ is sensitive to evaporation and precipitation, and hence to the massive amount of fresh water ice periodically locked up in continental ice and snow. It is measured in ice cores, in benthic deep ocean sediments, and in the tiny carbonate shells of planktonic foraminifera from ocean sediments. Using such measurements as proxies for global ice volume, as well as direct calibration from the drowning of corals by rising sea water at various times and places around the globe, a composite sea level curve for the past 800,000 years was constructed by Spratt and Lisiecki (2016; see Figure 2.4, bottom). The timing of cycles in global temperature (upper figure) matches that of the cycles in sea level (lower figure). The most impressive part of the pattern is the regular major oscillation of warm versus cool temperatures as well as high vs. low sea level; warm peaks at points A, C, E, G, and I occur at intervals of about 100,000 years, as do those of alternating cold periods at B, D, F, and H. Astronomers and climate scientists have noted that our earth has a slightly eccentric orbit, caused by the pull on the earth of Jupiter and Saturn. This eccentricity occurs on a 100,000 year cycle, and it constitutes one of several so-called Milankovitch cycles, named for a Serbian geophysicist and astronomer. This orbital eccentricity is thought to cause a variation in the amount of solar warming reaching the earth—hence periodic glaciation (Imbrie et al. 1992).

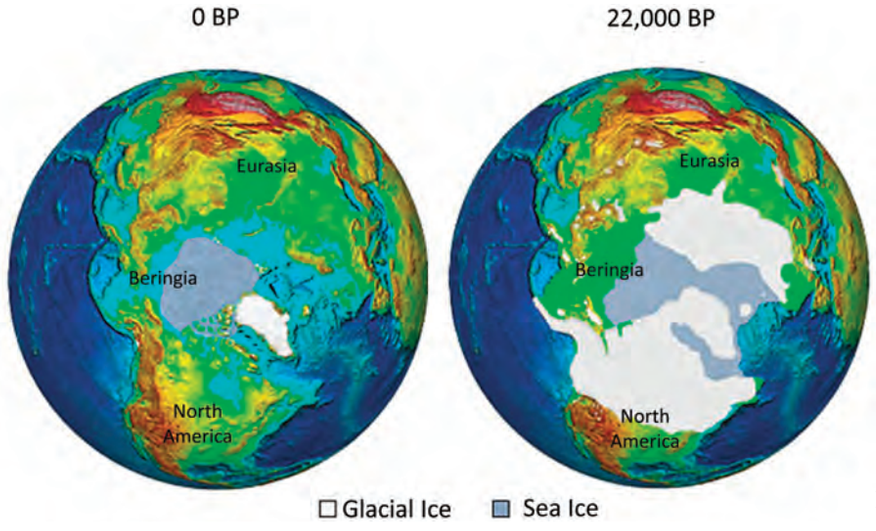



Figure 2.3. North polar ice cap at maximum glaciation (22,000 years before present, B) and mini-mum (today, A). During the LGM, massive Laurentide ice sheets up to 3.2 km thick blanketed Canada and the northern United States; the removal of that much water from the oceans at both poles caused global sea level to drop about 125 m, greatly expanding the area of exposed lowland (green) in Beringia as well as the coastal Texas lowlands. Image courtesy of the National Oceanic and Atmospheric Administration Paleoclimatology Program.

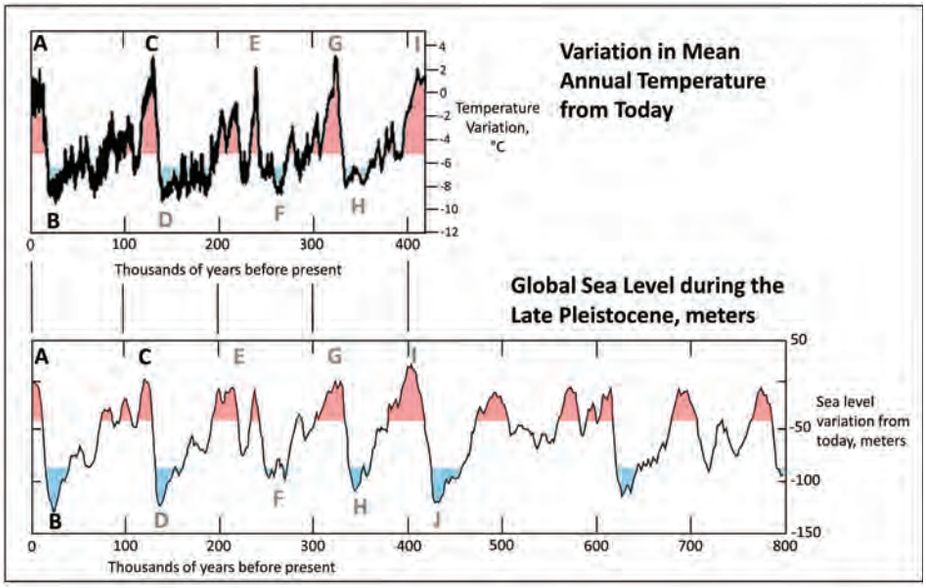

Variation in Mean Annual Temperature from Today
Temperature Variation, °C
Thousands of years before present
Global Sea Level during the Late Pleistocene, meters
Sea level variation from today, meters
Thousands of years before present

Figure 2.4. Top: Temperature varia-tions in degrees centigrade relative to today, for the last 400,000 years, de-rived from measurements of the deu-terium content of ice in the Vostok ice core, Antarctica (from Petit et al. 1999).
Bottom: Composite global sea level curve in meters for the Late Pleis-tocene (from Spratt and Lisiecki 2016). Horizontal scales of both figures are identical. Points A, C, E, G, and I represent major warm periods, and points B, D, F, H, and J represent major glacial periods, with a cyclicity of about 100,000 years. Point B, the Last Glacial Maximum, was about 22,000 years ago. Point C, the most recent peak of warming at about 120,000 years before present, corresponds to the time of formation of the Ingleside shoreline feature (a major sea level highstand) on the Texas coastal plain.

The changes in global sea level during the past 800,000 years somewhat resemble the path of a yo-yo going up and down, over and over again. That recurring change in sea level and climate, coupled with effects of onshore tectonics and the production of eroded sediment, combines to form the stratigraphic record. The most recent glacial cycle, spanning the last 120,000 years, is the one most illustrative of the overall process; Figure 2.5 shows sea level change during that one cycle in more detail. Events labelled A, B, and C, which bound the last glacial cycle, are labelled on both Figures 2.4 and 2.5. The green arrows illustrate three general periods: one of rising sea level ending at about 120,000 BP; a period of falling sea level ending at about 22,000 BP; and another period of rising sea level, extending until today. It is not clear how much more sea level rise will occur in the near future, although sea level was apparently higher in the last warm period (C) than it is today (A), as can be seen in the chart.

Quaternary geologists and climate scientists have further divided these three general periods into a number of Marine Isotope Stages (MIS; top of Figure 2.5); these stages are recognized globally, although details vary slightly among measurement sources. MIS 6 consists of rising sea level at the end of the previous glacial cycle. MIS 5 consists of the sea level highstand at the beginning of the last glacial cycle—which resulted when warm climate melted most of the polar ice caps—and the beginning of the fall in sea level that resulted as colder climate and polar ice returned. That fall in sea level extended several tens of thousands of years until MIS 2, the so-called Last Glacial Maximum (LGM), when there was a concurrent maximum lowstand in global sea level, which was about 125 m lower than today. The last stage, MIS 1, occurred during the sea level rise that followed the LGM and involves more or less steadily rising sea level until today. It was during this interval of time as well as the preceding MIS2 that humans first arrived on the Texas coast.

During the period of generally falling sea level that occurred from MIS 5 to MIS 2, there were many smaller scale advances and retreats of glacial ice, and hence fall and rising of sea level; the black arrows drawn on the chart (Figure 2.5) high-

light several prominent sea level drops, each one lower than the previous one. There are especially prominent such troughs at 116,000 years, 64,000 years, and 22,000 years, each representing a sharp drop in river base level that led to the development of incised river valleys in onshore areas (more on this later).

## Coastal geology of the current glacial cycle

A geologic map of the Texas coast (Figure 2.6) and an associated cross section (Figure 2.7) display seaward thickening layers of Miocene through Pleistocene strata. On the map the youngest of these layers of clastic strata (leaving out Holocene river alluvium) consists of the Late Pleistocene Beaumont Formation, which formed primarily during the highstand and early falling stage of the last glacial stage (MIS 5) as well as the rising phase (MIS 6) of the previous glacial cycle (Figure 2.5; Solis 1981; Blum and Aslan 2006). It is successively underlain by older strata that outcrop farther to the north and west: the Middle Pleistocene Lissie Formation (orange on the map), the Pliocene Willis Formation (bright green), and the Miocene Goliad, Fleming and Oakville formations (dark green, light blue, and medium blue). These strata all dip southward and eastward (basinward), as can be seen in the stratigraphic cross section of Figure 2.7 (location shown on Figure 2.6).

The Beaumont outcrop reflects two basic types of sediment, including a muddy, clay-rich alluvial and deltaic floodplain that is transected by now abandoned channels filled with sandy material (Winker 1979). These two facies are differentiated on the map by a subtle color change that is evident upon closer inspection of that document (see inset map, Figure 2.6); the sandy channels are lighter in color. These abandoned channels often transect younger, modern creeks and bayous in the

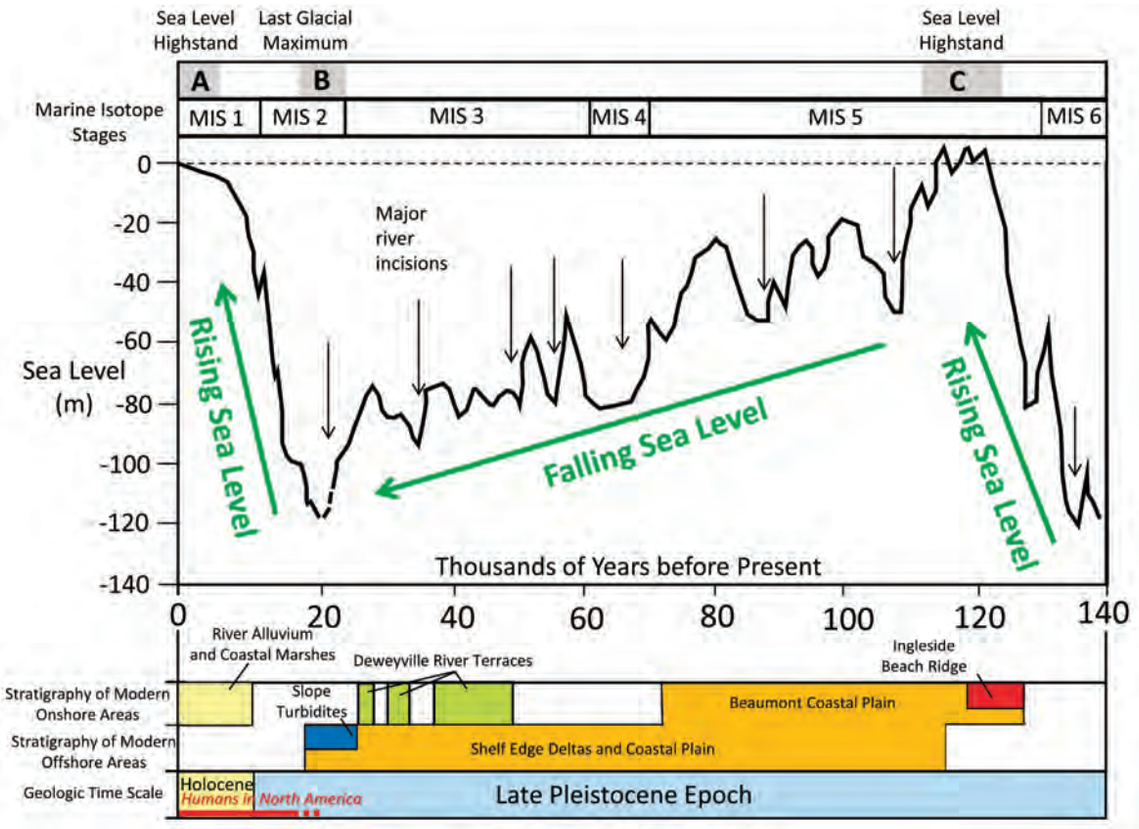



Figure 2.5. Time chart showing sea level and coastal stratigraphy over the last glacial cycle. Top: Composite sea level curve, 140,000 BP to present. Curve for 140,000 to 22,000 BP taken from Shackleton (1987); for 22,000 to 10,000 BP, from Balsillie and Donoghue (2004); for 10,000 to present, from Milliken and others (2008a). Events A, B, and C correlate with those indicated in Figure 2.4. MIS refers to Marine Isotope Stages (see text). Bottom: Summary stratigraphic chart, made from various sources mentioned in the text.

Houston area, and are of historical interest, as the sandy outcrops provided good footing in fords for wagon crossings, in a setting that otherwise consisted of muddy gumbo outcrops that presented difficult footing for creek traverses.

The geologic map also highlights, in red, a low ridge of sandy soil that is the remnant of a Late Pleistocene barrier island. The sand ridge marks the position of the so-called Ingleside strandline, a geologic landmark of considerable current interest. The Ingleside barrier island sand interfingers with the Beaumont Formation on its landward side (Winker 1979; Solis 1981; see Figure 2.7). Its base has been dated by Simms and others (2013b) using optically stimulated luminescence techniques at 119,000 to 127,000 years BP, placing it squarely at the global sea level highstand at MIS 5. This strandline, located about 5 m higher than current sea level, thus marks the high-water mark of sea level during the last (previous) interglacial warm event. If the coastline reached a few tens of miles farther inland at that time, then there is every reason to expect that it may eventually do so again, because sea level continues to rise today. How rapidly that rise and coastal flooding occurs—over a few scores of years, or a few centuries, or a few millennia—depends upon one's projection of rates of global warming, as discussed later.

Figure 2.6. Geologic map of coastal Texas, courtesy of the Bureau of Economic Geology, Austin.

## Paleogeography of the falling stage of the current glacial cycle

Our primary goal in this chapter is to show the development in stages of the Texas coast during MIS 2 to MIS 1 (22,000 BP to present), the rising phase of sea level that occurred during (and perhaps partly after) the arrival of Native Americans in this region. However, it is well worth diverging a bit to breifly review the development of the coastal landscape during the previous falling stage (MIS 5 to MIS 2, or 120,000 BP to 22,000 BP) of the current glacial cycle, the final throes of which we still experience. Much of the topography that early Native Americans found was shaped by this falling stage, including the carving of the river valleys where most Native Americans lived, as well as the river gravel terraces that provided them high ground on which to build their shelters.

Figure 2.7. Stratigraphic cross section through the central Texas coast; location shown on Figure 2.6. The uppermost wedge of strata, with color highlighted, consists of fluvial-deltaic strata of the Beau-mont Formation (yellowish) as well as coastal barrier island sands of the Ingleside trend (reddish orange), all of Late Pleistocene age. Image from Solis (1981), courtesy of the Bureau of Economic Geology, Austin Texas.

### Late Pleistocene MIS 5 highstand and early falling stage

Today we live along a coast that is at the end of a glacial cycle, at a highstand in sea level (Figure 2.8, MIS 1). It is a relatively quiet time in terms of depositional systems, compared to any other part of the glacial cycle (Anderson et al. 2004; Owen 2008). Streams and rivers, even including the relatively large Brazos and Colorado rivers, are sluggish and slow moving except during times of flood. Broad inland meanderbelts in river valleys can store vast amounts of sediment, which consequently does not reach the sea (J. B. Anderson et al. 2014:14). Dryer climates and inland sediment storage mean smaller deltas, which for the most part are trapped in bays and do not get past the barrier island system.

The beginning of the last glacial cycle, 120,000 BP, was a very similar time of sea level highstand (compare positions A and C, Figure 2.5). Sea level rise had slowed to a standstill, and the climate was relatively warm and dry. Winker (1979, 1991), J. B. Anderson and others (2004, 2016), and other researchers have shown that the coastal margin was marked by an extensive alluvial plain of exposed Lissie

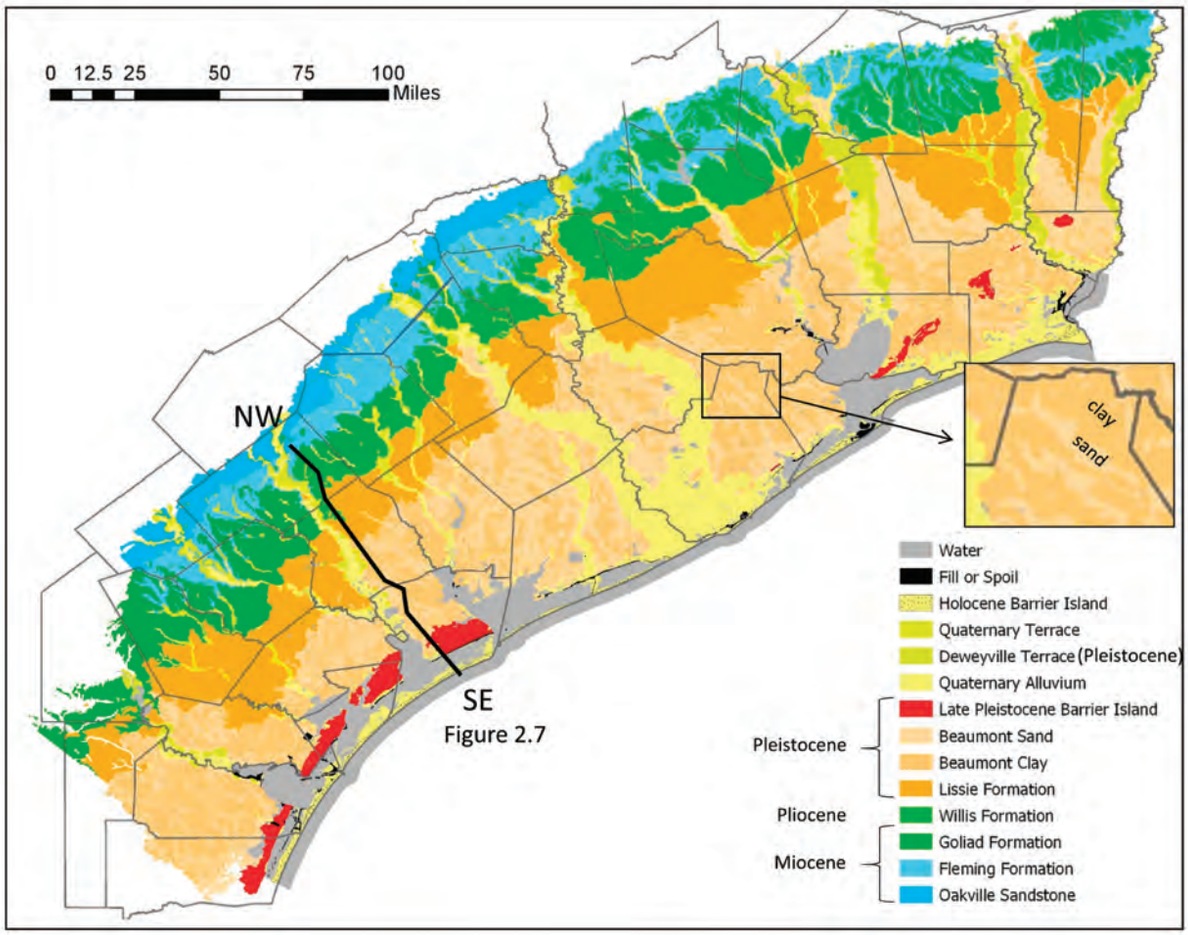
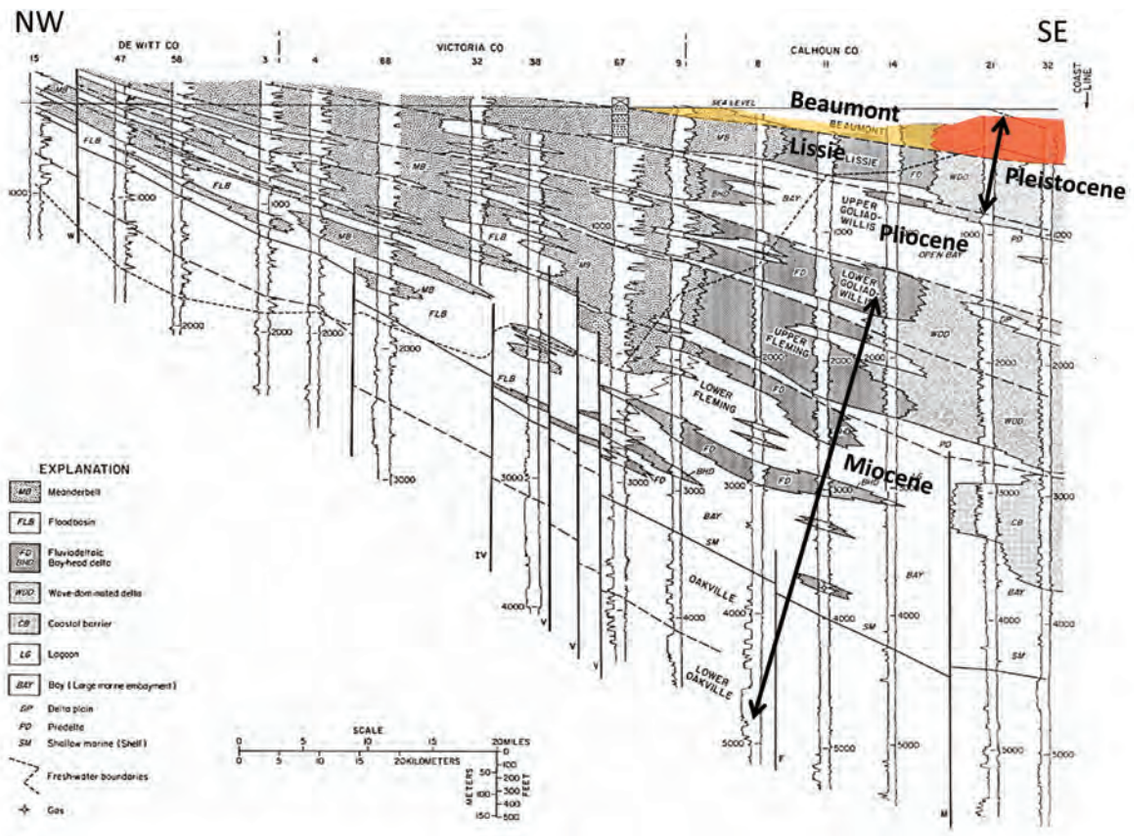

0 12.5 25 50 75 100
Miles
NW
SE
clay
sand
Water
Fill or Spoil
Holocene Barrier Island
Quaternary Terrace
Deweyville Terrace (Pleistocene)
Quaternary Alluvium
Late Pleistocene Barrier Island
Beaumont Sand
Beaumont Clay
Lissie Formation
Willis Formation
Goliad Formation
Fleming Formation
Oakville Sandstone
Pleistocene
Pliocene
Miocene

Figure 2.7


NW
SE
DE WITT CO
VICTORIA CO
CALHOUN CO
COAST LINE
Beaumont
Lissie
Pleistocene
Pliocene
Miocene
UPPER GOLIAD-WILLIS
LOWER GOLIAD-WILLIS
UPPER FLEMING
LOWER FLEMING
OAKVILLE
LOWER OAKVILLE
EXPLANATION
Meanderbelt
Floodbasin
Fluviodeltaic Bayhead delta
Wave-dominated delta
Coastal barrier
Lagoon
Bay (Large marine embayment)
Delta plain
Prodelta
Shallow marine (Shelf)
Freshwater boundaries
Gas
SCALE
20MILES
20KILOMETERS
METERS
FEET

and lower Beaumont nonmarine clastic sediments (Figure 2.9). And as in our own time, the coast was marked by a series of barrier islands (the aforementioned Ingleside trend of sand ridges) with inland bays.

Such a peaceful geologic scene was not to last. Cooling temperatures and a resurgence of the polar ice caps marked a sharp drop of nearly 50 m in sea level at about 108,000 BP, the first of several such severe drops as sea levels (and climate) bobbed back and forth during the middle and late parts of MIS 5 (Figure 2.5). The landscape response was severe (Figure 2.10). A 50 m drop in sea level meant an equal lowering of base levels for river erosion. "Base level" means the elevation of the mouth of a river, where it meets the sea. When an abrupt drop of sea level occurs, rivers begin to cut downward as the landscape seeks to accommodate the new, lower base level, producing incised river valleys (the reddish-brown pattern in Figure 2.10). This was the opening salvo in a series of repeated incisions of Texas rivers over the next 80,000 years. At the same time, cooler weather was accompanied by a more humid climate, and rivers carried more sedimentary load as the material incised from the valleys made its way to the coast. River deltas began to grow outward from the coast, with the larger ones (Colorado, Brazos, and Trinity) escaping the confines of the Ingleside barrier island chain. (Note: Blum and Aslan [2006] have differentiated MIS 5 upper Beaumont river channels from MIS 6 earlier Beaumont strata for the Brazos, Colorado, and Trinity rivers. They are not differentiated on Figure 2.10).

Those MIS 5 falling stage deltas rapidly built out in lobes across the shallow waters of the continental shelf (Anderson et al. 2016). The locations of the deltaic lobes were mapped by Anderson et al. (2016) from previous coastal studies. The proximal ends of their delta plains were above sea level, and their distal (oceanward) margins were slightly below sea level. A seismic line from Anderson and others (2004) extends from near the modern shoreline to the edge of the continental shelf and shows, at its north end, the front of that early MIS 5 delta (Figure 2.11). In essence, the abrupt drop in base level plus the increase in rainfall during a global cool period caused material to be taken via erosion from interior areas, forming incised river channels, and then brought to the sea, there to be deposited in growing shelf delta systems.

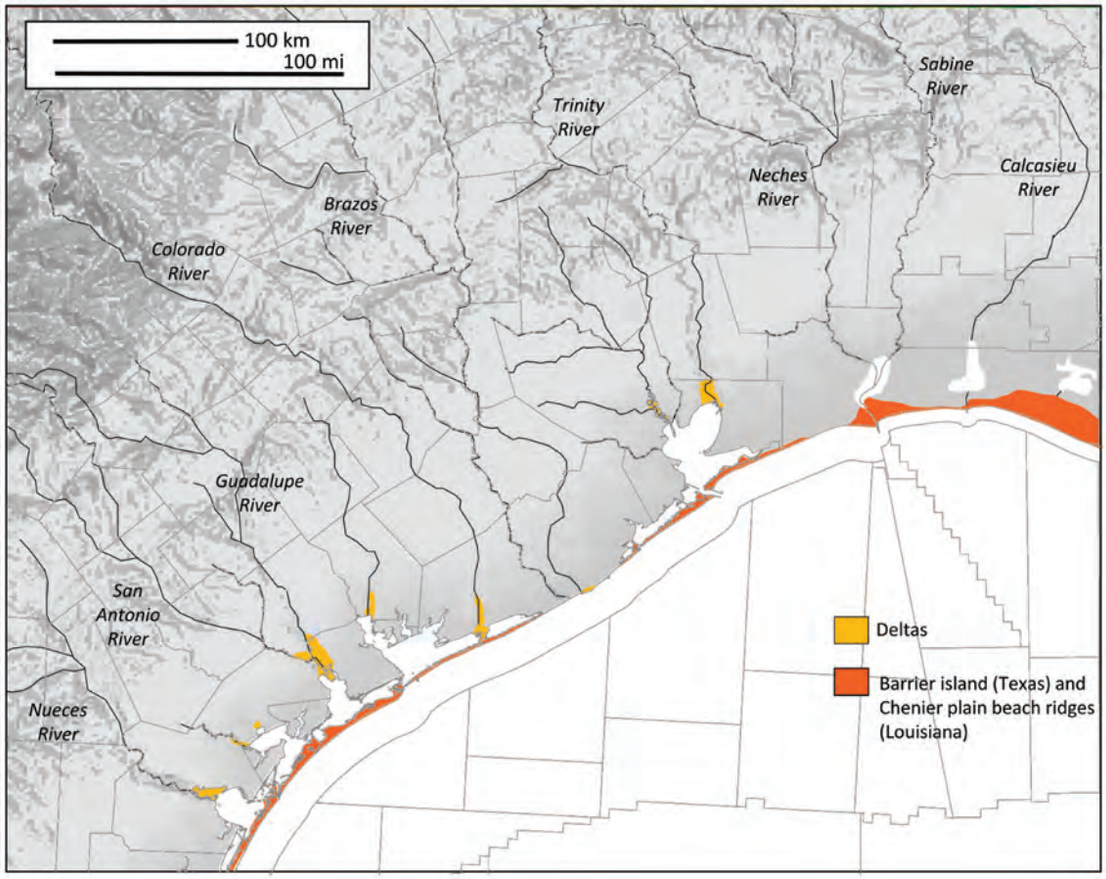
Figure 2.8. Depositional systems of the Texas coastal zone during the late Holocene, the last half of MIS 1 (ca. 4,000 BP to present). Coastal geology from Anderson and Rodri-guez (2008a) and Owen (2008).

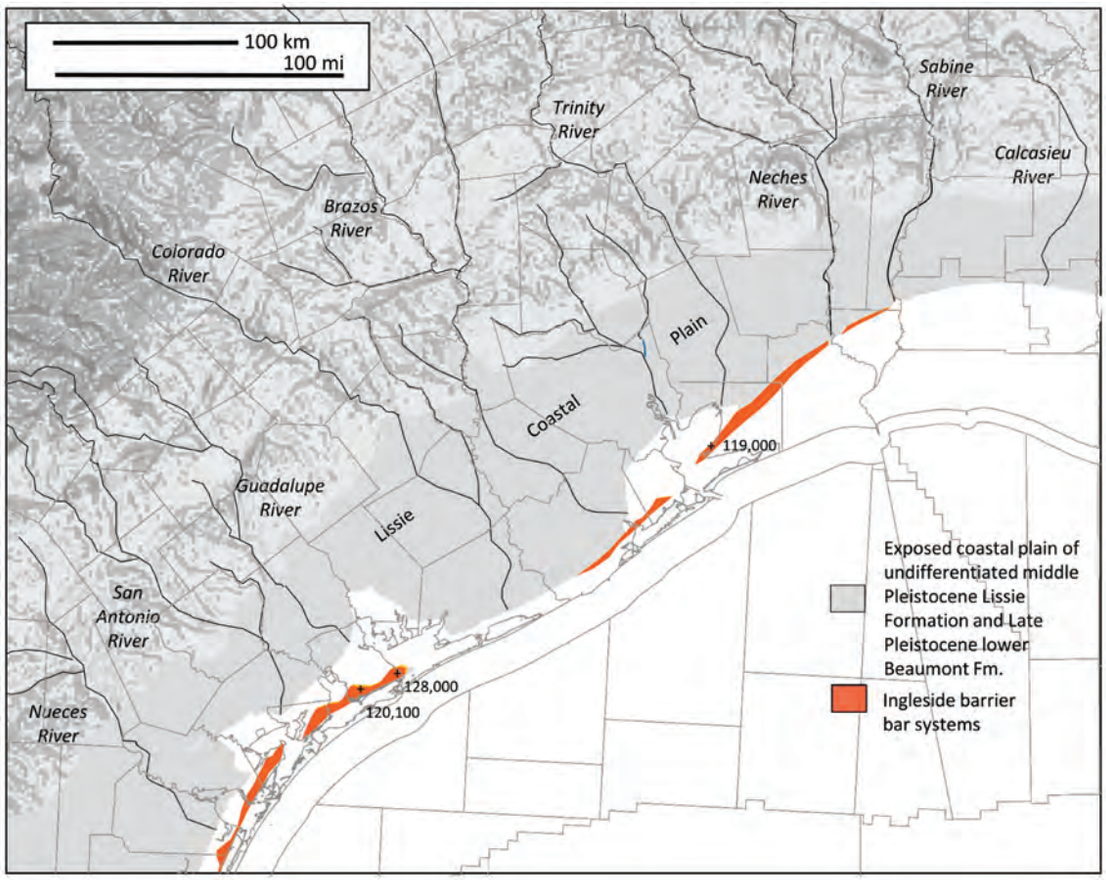
Figure 2.9. Late MIS 6 and MIS 5 highstand depositional systems, Texas coastal zone, ca. 120,000 BP. It was a time of relatively dry and warm climate with high river base levels; there was little deltaic deposition on an exposed Lissie coastal plain. Ingleside trend barrier islands are taken from Winker (1979) and from Simms and others (2013). Cores that penetrate the base of Ingleside barrier island facies (+) include radiometric dates that are in calibrated years BP, from Simms and others (2013).

### Late Pleistocene MIS 3 late falling stage

During MIS 4 and 3, sea level continued to fall. Shelf-edge deltas shifted the focus of deposition outward, prograding ever-seaward (Figure 2.12). Seismic data (Figure 2.11) display deltaic clinoforms (basinward-dipping surfaces formed by the advancing delta front), of which the last—near the edge of the modern continental shelf—marks the position of the delta at the end of stage MIS 3 (Anderson et al. 2004; Simms et al. 2007; Suter and Berryhill 1985).

General sea level fall was punctuated by sharp second order oscillations (caused by very rapid, brief changes in climate and global ice volume) that produced spikes in low and high relative sea level (Figure 2.5). In upland settings, this produced a recurring pattern of incision during sea level fall, valley fill during sea level rise, and re-incision as sea level fell even farther, as shown diagrammatically for the Trinity River in Figure 2.13, after a cross section prepared by Galvin (2008) and by Blum


100 km
100 mi
Sabine River
Trinity River
Neches River
Calcasieu River
Brazos River
Colorado River
Guadalupe River
San Antonio River
Nueces River
Deltas
Barrier island (Texas) and Chenier plain beach ridges (Louisiana)


100 km
100 mi
Sabine River
Trinity River
Calcasieu River
Neches River
Brazos River
Colorado River
Plain
Coastal
119,000
Guadalupe River
Lissie
San Antonio River
128,000
120,100
Nueces River
Exposed coastal plain of undifferentiated middle Pleistocene Lissie Formation and Late Pleistocene lower Beaumont Fm.
Ingleside barrier bar systems

and Aslan (2006) and Blum and others (2006). The location of the cross section is shown in Figure 2.12. In section A, sharply dropping sea level lowers river base level, and the Trinity River carves a deep channel (incised valley) in the coastal plain. As sea level recovers, base level rises again and the valley fills with alluvial sediments (the pink strata in section B, radiometrically dated at 50,000–35,000 BP). As sea level drops again, the river again excavates the valley, but in a slightly different location, leaving behind a perched remnant of the former alluvial fill (Deweyville Terrace 1, section C). A second valley fill of 33,000–24,000 BP age (section D) was cut, leaving Deweyville Terrace 2 (section E). The pattern was repeated yet again at the end of MIS 3, leaving Deweyville Terrace 3 (sections F and G), which was incised by the lowest sea level fall at MIS 2 at the Last Glacial Maximum (22,000 BP; section G). The result is the incised valley of the Trinity River with its series of "Deweyville" perched alluvial terraces. The pattern is repeated in other area rivers, and the modern day outcrop of these terraces is shown in Figure 2.12 in green. Ages of alluvial fill vary from valley to valley, depending somewhat upon local conditions. These perched terraces are typically where inland Native Americans would choose to dwell while living in upland river basins, as evidenced by numerous archeological sites throughout Southeast Texas. Such sites had the advantage of being close to the river but comfortably above the water level of most floods.

Figure 2.10. MIS 5 early falling stage depositional systems, Texas coastal zone, ca. 120,000 to 110,000 BP. Onshore alluvial plain deposition-al systems of the undifferentiated Beaumont Formation are taken from Winker (1979) and Solis (1981). Ingleside trend barrier islands are from Winker and from Simms and others (2013). MIS 5 Upper Beaumont alluvial fans are taken from Blum and Aslan (2006), with coeval offshore deltas from Anderson and others (2004). Dashed arrows indicate areas of sand-rich alluvial channels, taken from Blum and Aslan as well as from Winker. Core locations penetrating the base of Ingleside barrier island facies (+) are in calibrated years BP, from Simms and others (2013). Dark straight line at lower center shows the location of the seismic line shown in Figure 2.11.

## Late Pleistocene MIS 2 lowstand at the Last Glacial Maximum

Sea level continued to fall with continued growth of the polar ice caps, until a maximum was reached during MIS 2, at about 22,000 BP (Figure 2.5). At this time, sea level reached 125 m deeper than present day sea level, and this abrupt drop resulted in the deepest incisions of stream valleys in this glacial cycle. River systems reached across the modern shelf to the modern shelf edge, and incised the entire width of the shelf, including the previous MIS 6–MIS 3 deltas (Figure 2.14). A cross section example of these late stage incisions is shown in Figure 2.15, which displays the cut made by the Lavaca/Navidad River. The incised channel of that small river system is 40 m deep, and was partly filled by fluvial (nonmarine) strata before being filled by deltaic and marine strata as sea level rose during late MIS 2 and MIS 1 (Anderson et al. 2016).

Figure 2.12. Late MIS 3 late falling stage depositional systems of the Texas Coastal Zone, ca. 40,000 to 23,000 BP. Onshore incised channels are shaded brown. Deweyville river terrace deposits (green) are from the Texas Bureau of Economic Geology's Geologic Map of Texas. Positions of offshore channels and shelf-edge deltas are modified from several sources (Anderson et al. 2004; Simms et al. 2007); Berryhill et al. 1986). Radiometric dates from cores that penetrated the sequence boundary (+) are given in calibrated years BP (from Simms et al. 2007) except for the 46,000 BP date (from Evans 2012).

Although only the major rivers are highlighted as "incised" on the map in Figure 2.14, in fact nearly all minor streams, creeks, and bayous of the region experienced varying levels of incision, and the steep results of that Late Pleistocene erosion are evident today. The banks of Buffalo Bayou, White Oak Bayou, Cypress Creek, and other streams of this area display steep banks of 2 to over 10 meters (6 to 30

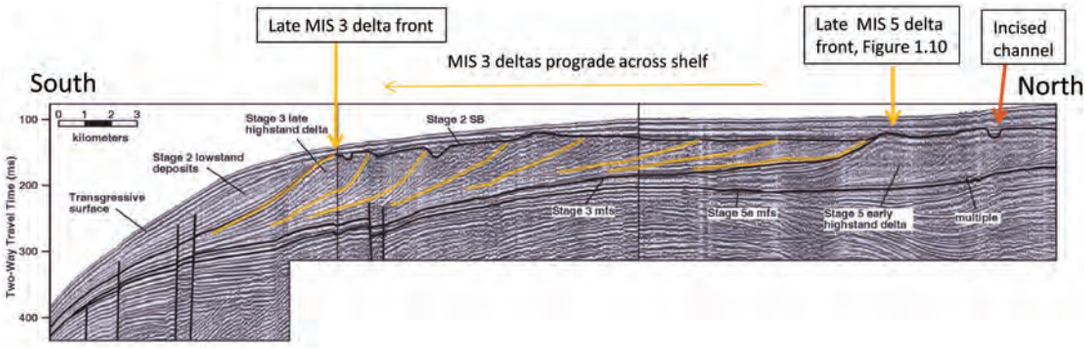
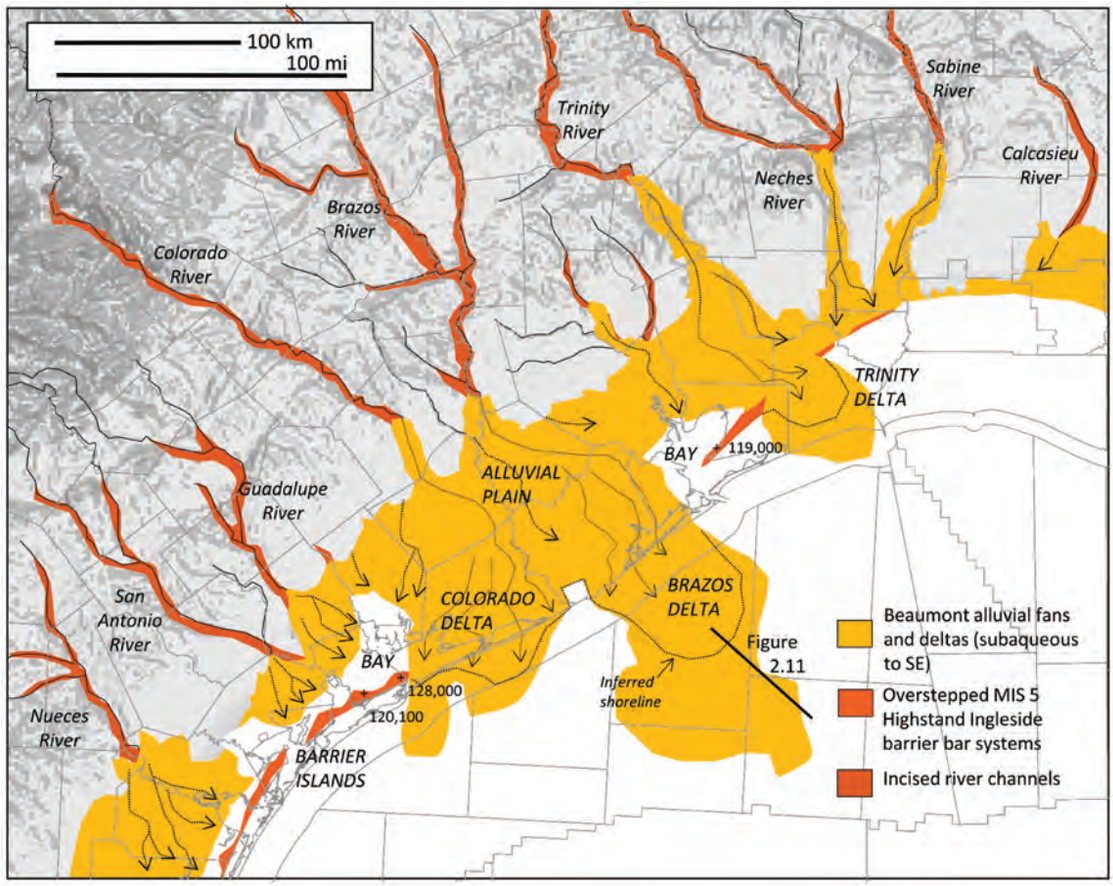
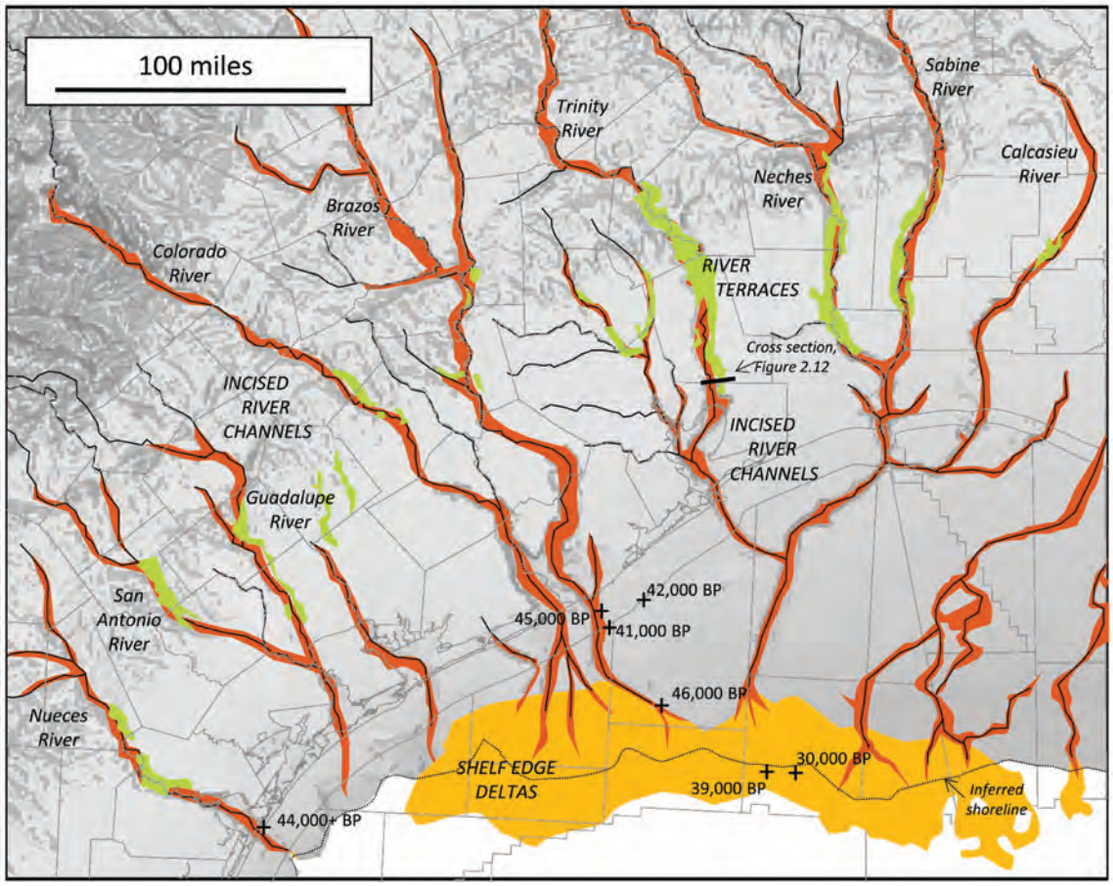



Fig. 2.11. Interpreted seismic lines G-300X and line G-90Y, two connecting dip-oriented profiles collected along the depositional axis of the falling stage Brazos delta (modified from Rodriguez et al. 2000b; Anderson et al. 2004, 2016). Line location is shown in Figure 2.10.


100 km
100 mi
Trinity River
Sabine River
Calcasieu River
Neches River
Brazos River
Colorado River
TRINITY DELTA
BAY
119,000
ALLUVIAL PLAIN
Guadalupe River
San Antonio River
COLORADO DELTA
BRAZOS DELTA
Figure 2.11
BAY
128,000
120,100
Inferred shoreline
Nueces River
BARRIER ISLANDS
Beaumont alluvial fans and deltas (subaqueous to SE)
Overstepped MIS 5 Highstand Ingleside barrier bar systems
Incised river channels


100 miles
Trinity River
Sabine River
Calcasieu River
Neches River
Brazos River
Colorado River
RIVER TERRACES
Cross section, Figure 2.12
INCISED RIVER CHANNELS
INCISED RIVER CHANNELS
Guadalupe River
San Antonio River
42,000 BP
45,000 BP
41,000 BP
46,000 BP
Nueces River
SHELF EDGE DELTAS
30,000 BP
39,000 BP
Inferred shoreline
44,000+ BP

feet) that rise from the eroded valley floor at low water stage. Such breaks in otherwise flat topography that occurred along these narrow minor streams were used to great effect in hunting by early human occupants of Southeast Texas (Chapter 8).

The incised channels reached across the former shelf-edge deltas to the shelf margin, where they released their clastic sediment cargo into the continental slope, both as unstable debris flows on the steep slope (Figure 2.16 shows a diagrammatic representation), and as turbid flows that poured sediments into intraslope minibasins created by salt diapirs. At the mouth of the Colorado, the East Breaks Slide (Figure 2.14) is a large unstable body of such Colorado River–sourced Pleistocene sediments that slid basinward under the force of gravity on the steep slope (Winker 1996; Winker and Booth 2000). At the mouth of the joined Brazos-Trinity-Sabine drainage system, a series of minibasins on the slope acted as ponded catchments for turbid flows of sand and mud that spilled onto the slope during the maximum lowstand in sea level (Winker 1996; Pirmez et al. 2012). Sediment cores taken through deepwater turbidites in these ponded basins (Figure 2.14) range in age from 24,300 to 15,300 BP, which brackets the glacial maximum. At the eastern edge of the map in Figure 2.14, channels transecting a shelf edge delta system that is believed to have been connected to the Pleistocene Mississippi River (Berryhill et al. 1986) spilled sediments onto the continental slope creating submarine slides not unlike those of East Breaks (Suter and Berryhill 1985: Fig.18b).

Figure 2.14. Depositional systems of the Texas Coastal Zone during the Last Glacial Maximum (MIS 2), ca. 24,000 to 19,000 BP. Onshore incised channels (brown) are from Bureau of Economic Geology, Geologic Map of Texas. Offshore channels and shelf-edge deltas are modified from several sources (Anderson et al. 2004; Simms et al. 2007; Suter and Berryhill 1985; Pirmez et al. 2012). Deepwater fans are from Pirmez and others, as are depositional age dates in thousands of calibrated years BP (in red) from cores that penetrated the fans.

During the glacial maximum that occurred during MIS 2, the Texas climate was about three to four degrees Centigrade cooler than today (Shakun et al. 2012; see discussion, Chapter 3, this volume). In the subtropical climate of Houston, this did not have the large effect that occurred in the much cooler northern half of North America, but that cool weather was accompanied by wetter weather, according to paleoclimate studies (Cordova and Johnson 2019). With that rain came the greater amounts of sediment load carried by streams, resulting in the rapid outgrowth of deltas and in the deposition of turbidites at the shelf margin.

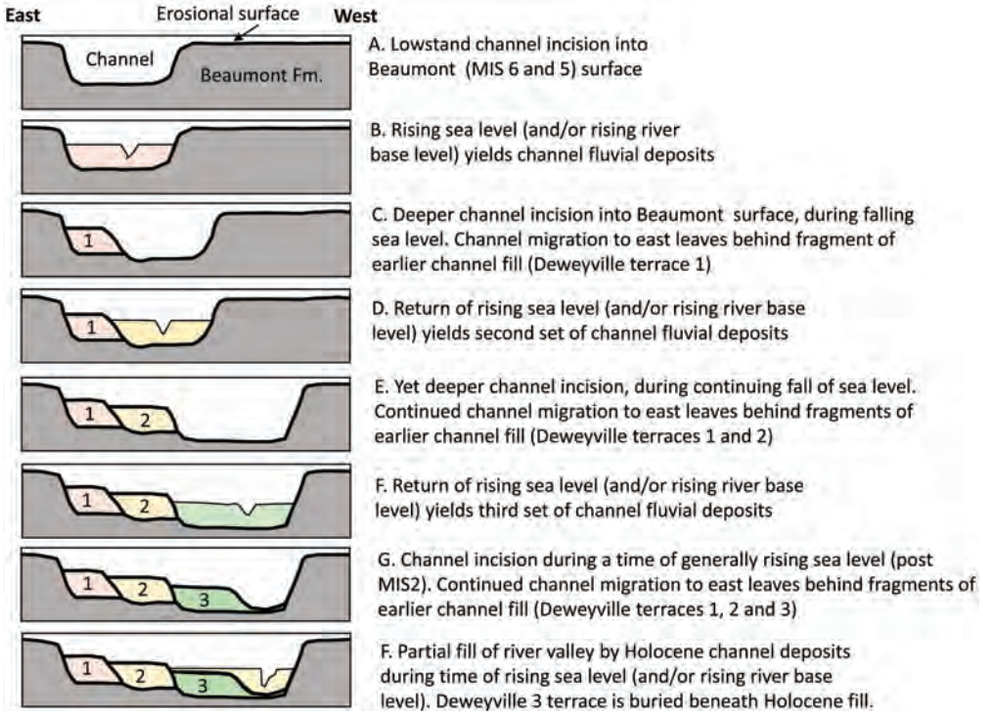

East
Erosional surface
West
Channel
Beaumont Fm.
A. Lowstand channel incision into Beaumont (MIS 6 and 5) surface
B. Rising sea level (and/or rising river base level) yields channel fluvial deposits
1
C. Deeper channel incision into Beaumont surface, during falling sea level. Channel migration to east leaves behind fragment of earlier channel fill (Deweyville terrace 1)
1
D. Return of rising sea level (and/or rising river base level) yields second set of channel fluvial deposits
1 2
E. Yet deeper channel incision, during continuing fall of sea level. Continued channel migration to east leaves behind fragments of earlier channel fill (Deweyville terraces 1 and 2)
1 2
F. Return of rising sea level (and/or rising river base level) yields third set of channel fluvial deposits
1 2 3
G. Channel incision during a time of generally rising sea level (post MIS2). Continued channel migration to east leaves behind fragments of earlier channel fill (Deweyville terraces 1, 2 and 3)
1 2 3
F. Partial fill of river valley by Holocene channel deposits during time of rising sea level (and/or rising river base level). Deweyville 3 terrace is buried beneath Holocene fill.

Figure 2.13. Schematic development of multiple terraces in a Trinity-style river valley during falling sea level of MIS 3, Late Pleistocene. Bottom section modified from Blum and Aslan (2006), after Galvin (2008); see Figure 2.12 for location.

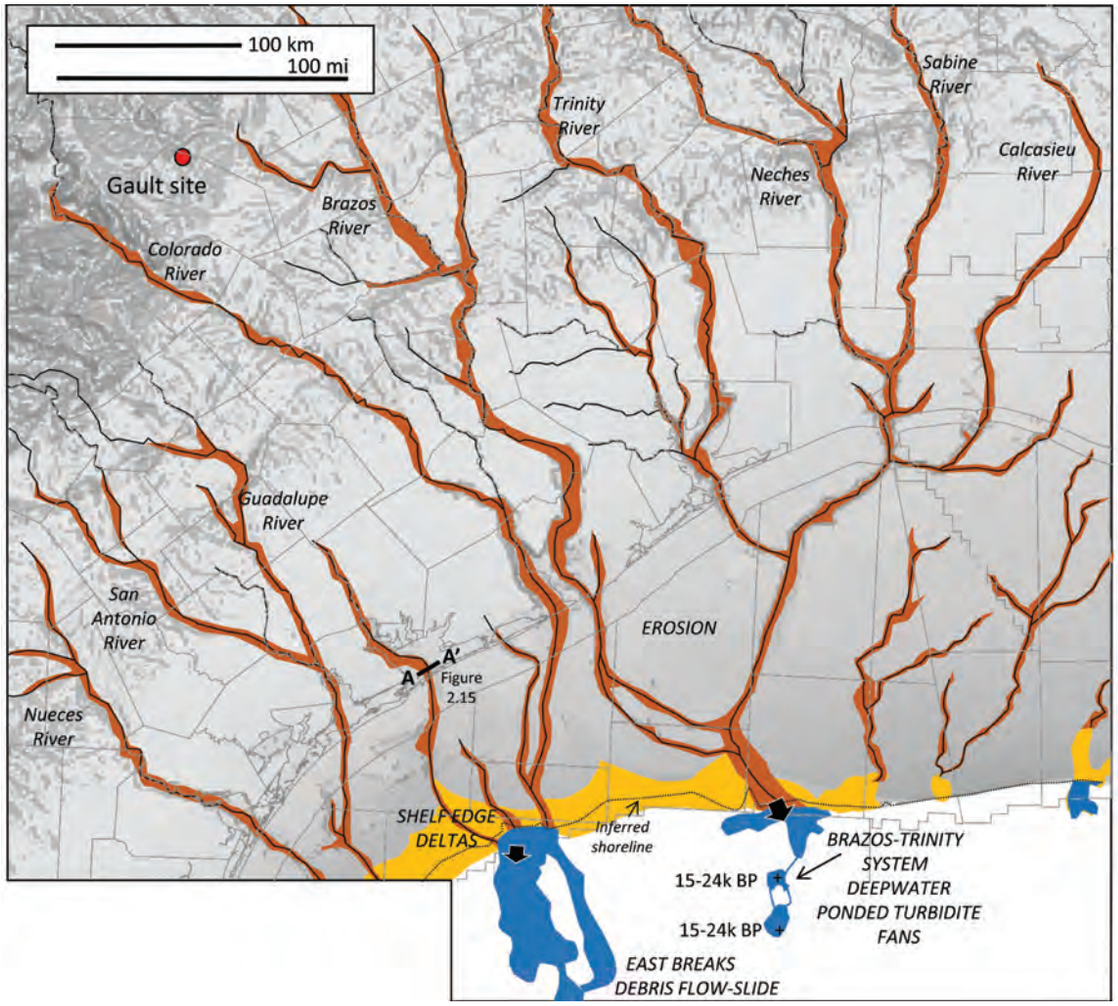
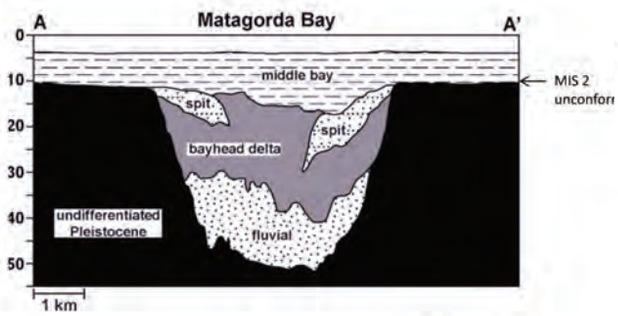



Figure 2.15. Incised channel of the paleo-Lavaca/Navidad River, now flooded and beneath Matagorda Bay (see Figure 2.14 for location). After the final incision was made during the Last Glacial Maximum, the valley was partly filled with alluvial sediments and then, with encroaching sea level, a bayhead delta formed and the valley was buried. It then received and is receiving a thin coat of marine bay muds (Anderson et al. 2016).



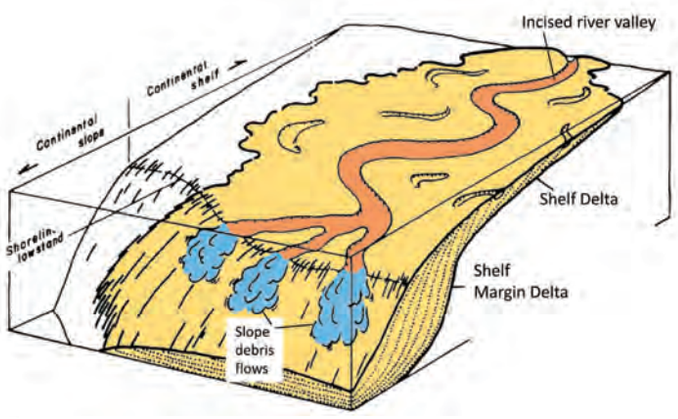




Figure 2.16. Generalized model of deltaic deposition during falling sea level. Modified from Suter and Berryhill, 1985.

## Preparing paleogeographic maps

With that brief review of the first "falling" part of the last glacial cycle, we now turn to the construction of a set of paleogeographic maps of the second "rising" part, as sea level made its 125 m ascent from the Late Pleistocene (22,000 BP) lowstand to the present highstand (Figure 2.5). These maps are used later in this report to help us understand the activities of early Native Americans, as deduced from archeological and ethnohistorical data. In geological terms, it is a very brief period of time.

The general idea is first to compile two items: a regional structure contour map of the MIS 2 unconformity surface, the core of which is taken largely from the work of Simms and others (2007: Fig. 18), and a locally calibrated sea level curve that relates changing sea level in the Gulf of Mexico to time in years before present (Figure 2.19), taken from the work of Balsillie and Donoghue (2004), and Milliken and others (2008a). At its very simplest, one could take the elevation of sea level at a particular point in time from the sea level curve, and project it on the map of the erosional surface that had been exposed at the sea level lowstand. For example, sea level 13,000 years ago was 65 m lower than it is today, so it is likely that the 65 m contour on the map of the erosional unconformity approximately marks the edge (coastline) of the rising ocean at that time.

The coastline transgresses (moves landward) with time as sea level rises, and the process is a bit like water filling a bathtub. Such a simple projection is feasible because key parts of the Southeast Texas shelf experienced little sedimentation prior to inundation and continue to see very low sedimentation rates today; effects of potential isostatic rebound are thought minimal. The process of calculating paleo-coastlines is not that simple, however, and there are significant issues to overcome. Sea level curves contain a cloud of inaccuracy in measurement of both time and depth that can be significant. Fortunately, the sediment cores acquired during extensive core studies across coastal Texas bays and the offshore shelf help constrain the geographic and temporal position of paleo-coastlines, independent of the projection of locations and depths from sea level curves. A second difficulty lies in areas where significant sedimentation has occurred on top of the eroded MIS 2 surface during the 22,000-yearlong rise of sea level—in particular, where continued deposition along deltas of the Brazos and Colorado rivers has occurred throughout sea level rise. Here the elevation of the MIS 2 erosional surface is not useful for tagging paleo-coastline location, as the coastline arrived on top of the overlying delta, which was deposited after the MIS 2 erosion but before drowning of the coastline at that point. Core studies again help constrain the result, allowing a general coastline to be estimated for the delta area.

Each of these steps and issues is taken up in more detail in the discussion that follows.

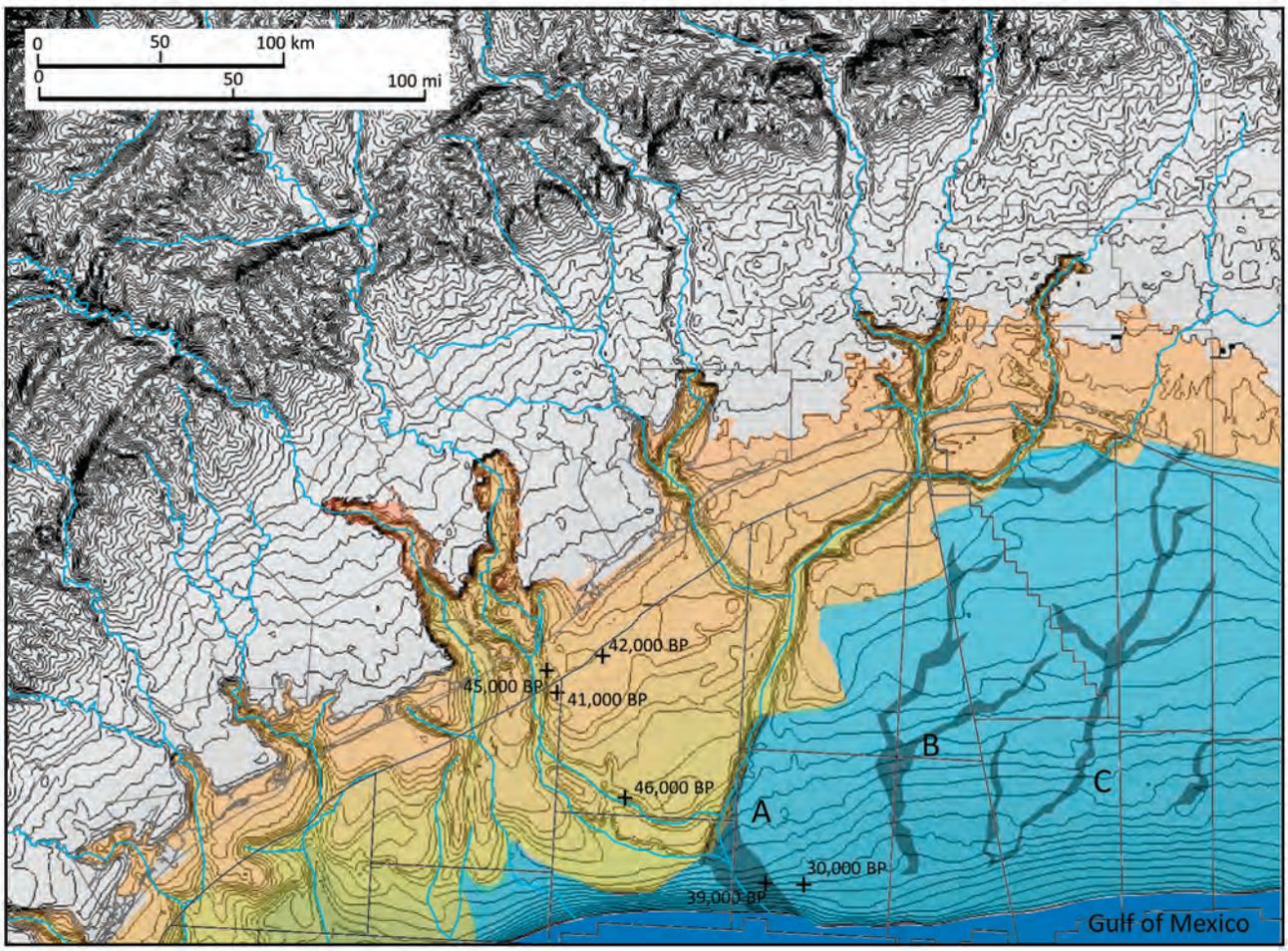
Figure 2.17. Structure map of the MIS 2 unconformity/ sequence boundary, showing Late Pleistocene topography and the locations of incised valleys. Data for the offshore yellow and orange areas is from Simms and others (2007). Onshore modern topography is from U.S. Geological Survey data. Contour interval is 5 m, beginning at the Late Pleistocene shoreline at -125 m. Contours in the area shaded light blue are extrapolated from bathym-etry and sparse core data and should be considered approximate (Wellner et al. 2004, see explanation in text). Locations of gray-shaded river valleys are: valley A (Pirmez et al. 2012), and valleys B and C (Suter and Berryhill 1985; Berryhill et al. 1986). There are no available seismically-derived con-tour maps for these channels, so their depths are neither shown nor implied.

### Creating a structure map of the MIS 2 unconformity

The first step in making the series of paleogeographic maps is to compile a structure map for the study area of an erosional unconformity that occurred at the time of the maximum lowstand at 22,000 BP. At this time, the entire modern continental

shelf was exposed to erosion (Figure 2.14). As sea level rose, this surface became an unconformity buried by marine, deltaic, and fluvial sediments, as shown in the Matagorda Bay cross section of Figure 2.15, where fluvial, deltaic, and bay sediments have buried both an incised MIS 2 channel and the underlying Pleistocene landscape (in black). The MIS 2 unconformity has been mapped for nearshore parts of Texas and southwesternmost Louisiana using marine sparker seismic data, by Simms and others (2007); their structure contour map is displayed as the central yellow and orange area of Figure 2.17. In onshore areas a modern topographic map was used as a close substitute for the Late Pleistocene erosional surface, because rates of erosion in the intervening 22,000 years are assumed to have been low relative to the amount of topographic relief.

There is unfortunately no corresponding structural contour map of the MIS 2 surface for the Louisiana shelf (the blue-shaded portion of Figure 2.17), either for the flat-lying main expanses or for the base of the incised channels that transect it. However, Berryhill and others (1986) and Suter and Berryhill (1985) have mapped the locations of "Late Wisconsin" (approximately MIS 2) channels, which are shown schematically in Figure 2.17 (channels B and C). The channels that they mapped represent not only the time of lowest sea level (and hence deepest stream incision, at MIS 2), but also include channels related to the previous falling stage, during MIS 3 and 4. There is no map of the MIS 2 channels alone, and thus no detailed map of it is possible with current information. Thus only the schematic outlines of the largest of the Louisiana channel systems are shown on the structure map of Figure



2.17 and on the paleogeographic reconstructions (following).

Nonetheless, a rough approximation of the depth of the MIS 2 surface in the Louisiana shelf may be made for the main flat-lying areas that lie outside the channels. Berryhill and others (1986) and Coleman and others (1998) show that the thickness of the flat-lying interchannel, post-MIS 2 sedimentary deposits is quite thin and blanket-like in character over most of the southwestern Louisiana and easternmost Texas shelf; these strata are mostly marine muds that rest like a thin drape over the unconformity. An isopach map was created from sparse core data from Wellner and others (2004) that documented the thickness of post-MIS 2 fill, and those isopach thicknesses were subtracted from detailed bathymetric data to get a rough approximation of the depth of the MIS 2 erosional surface. The resulting map of the MIS 2 surface in the blue-shaded area of Figure 2.17 should be treated as a rough but useful approximation.

The highest relief topographic features on the MIS 2 map (Figure 2.17) consist of the incised river valleys of the coastal region that extend far into the onshore interior, into central and eastern Texas. Those valleys were eroded by the various falling stage spikes in low sea level (MIS 3–5), punctuated at the end by the MIS 2 maximum lowstand at 22,000 BP.

A three-dimensional model of the MIS 2 erosional surface (Figure 2.18) was built using seismic workstation software (more on that process later). It displays the low relief surface and its incised channels in a highly vertically exaggerated view that allows the entire length of the incised channels—onshore as well as buried offshore portion—to be observed more closely. Figure 2.18A displays the unconformity surface, and Figure 2.18B shows the corresponding topography today. Modern Galveston, Matagorda, and Corpus Christi Bays as well as Sabine Lake overlie the incised Pleistocene channels of their respective rivers, underscoring the fact that the bays are simply the drowned and partially filled headlands of those Pleistocene channels.

### Compiling a sea level curve for time to depth correlation

The construction of paleogeographic maps for the intervening years since MIS 2 requires a correlation of geologic time to the rise of sea level since the Last Glacial Maximum. If that sea level curve is reasonably accurate, and any sedimentation that occurs after MIS 2 erosion and before the subsequent marine transgression is minimal, then a coastline of a particular age can be projected to occur at a particular depth on the MIS 2 unconformity. For that purpose we have used portions of two sea level curves that were constructed with data taken from the Gulf of Mexico (Figure 2.19). Balsillie and Donoghue (2004) prepared a post MIS 2 sea level curve (the red line) for the northern Gulf of Mexico utilizing a large database of radiocarbon-dated sea level indicators from cores, such as strandlines, peat beds, and corals that were all drowned by rising sea level. The data they used were compiled from 23 previous Gulf of Mexico published sources and were compared with global sea level data. The result is an average of available data, and the adjacent dashed gray lines define an area of uncertainty that encloses about 96% of the data points used.

Milliken and others (2008a) constructed a sea level curve for Texas (the blue

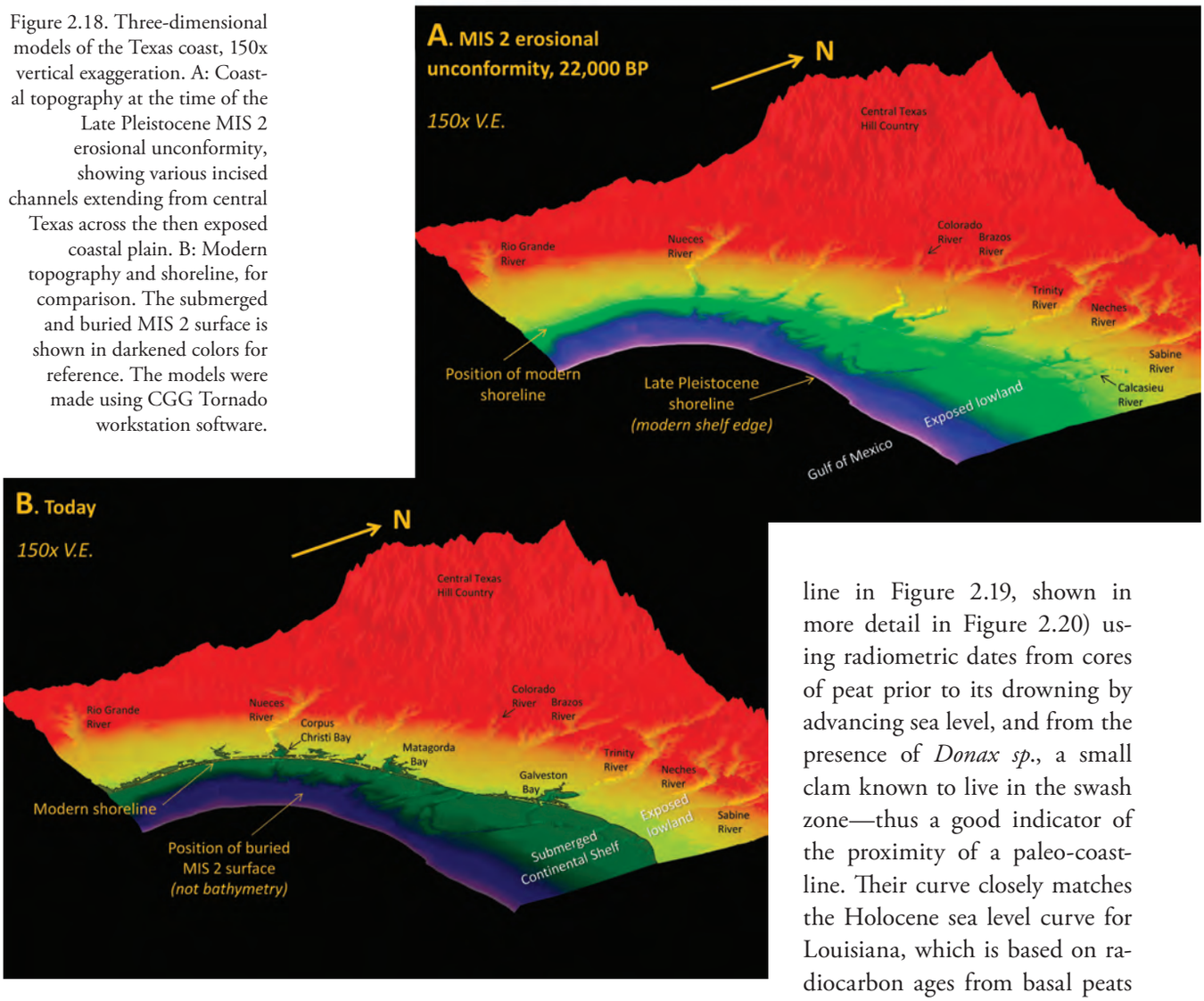



Figure 2.18. Three-dimensional models of the Texas coast, 150x vertical exaggeration. A: Coastal topography at the time of the Late Pleistocene MIS 2 erosional unconformity, showing various incised channels extending from central Texas across the then exposed coastal plain. B: Modern topography and shoreline, for comparison. The submerged and buried MIS 2 surface is shown in darkened colors for reference. The models were made using CGG Tornado workstation software.

line in Figure 2.19, shown in more detail in Figure 2.20) using radiometric dates from cores of peat prior to its drowning by advancing sea level, and from the presence of *Donax sp.*, a small clam known to live in the swash zone—thus a good indicator of the proximity of a paleo-coastline. Their curve closely matches the Holocene sea level curve for Louisiana, which is based on radiocarbon ages from basal peats that lie just above the Pleistocene surface, thus reducing error due to subsidence caused by sediment compaction (Törnqvist et al. 2004a, 2004b, 2006). The composite curve (Milliken et al. 2008a) shows a tight fit of data points, with relatively small horizontal (time) and vertical (depth) error bars. This curve was later modified by J. B. Anderson and others (2014) using data from Livsey and Simms (2013), who base their sea level curve on radiocarbon ages from algal mats in Baffin Bay, Texas (Figure 2.20). This approach limits error from radiocarbon reservoir effects and provides tight constraints on sea level.

For the purposes of constructing the paleogeographic maps of this report, the modified curve (Anderson et al. 2014) is used for ages less than 10,000 BP, and the Balsillie and Donoghue curve is used for ages greater than 10,000 BP. In both studies the calculated average (or in the case of Milliken and others, the best-fit regression) defines a general sea level pattern, but the data ranges show a propensity for error within a range of possibilities. In the Balsillie and Donoghue set, at an "average" age of about 14,000 BP, the error bars amount to +/- 1,300 years. Another issue regards significant reversals of rising sea level, such as the so-called Younger Dryas event,

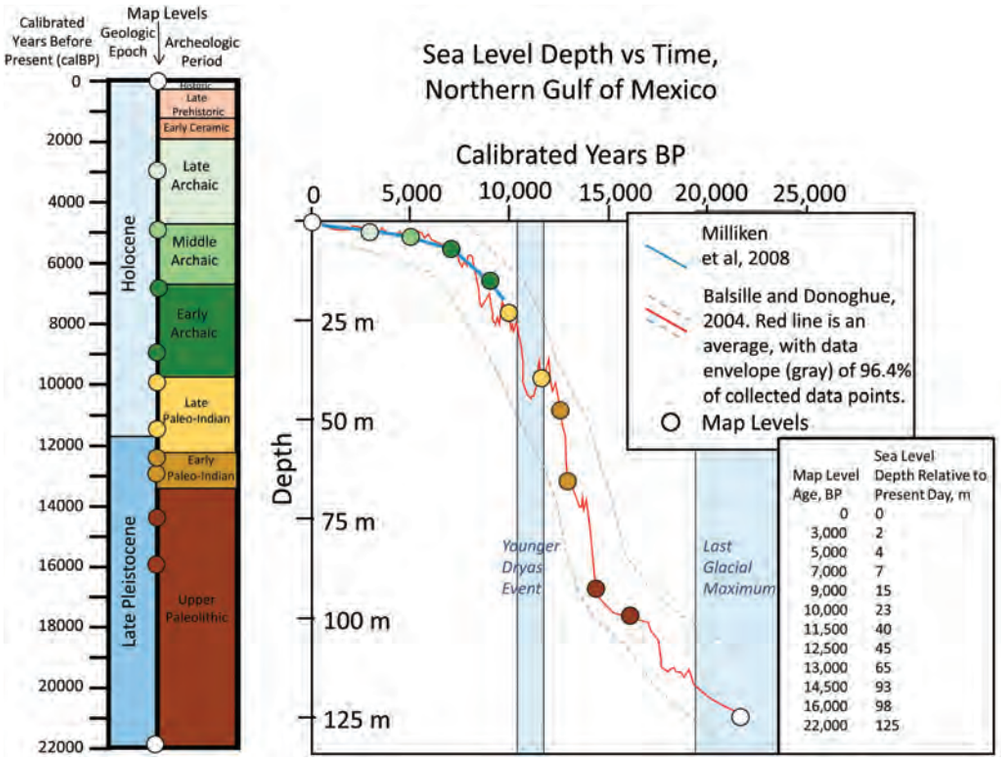


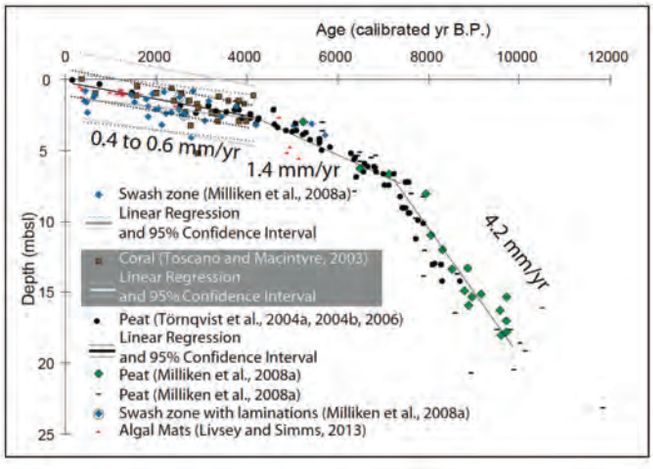

Figure 2.19. Correlation between time and sea level depth, northern Gulf of Mexico. Time positions paleogeographic maps derived from this correlation are shown in the column at left. The blue shading represents time of relatively cooler periods during the Last Glacial Maximum as well as the brief Younger Dryas Event.

a time of abrupt climatic cooling that interrupted an otherwise generally warming Holocene climate (Carlson 2013; see blue bar on Figure 2.19). Just before this brief climate reversal, sea level had risen to about 38 m, and then with the onset of the Younger Dryas event, returning glacial conditions at the poles led to a temporary fall in sea level to about 45 m. This bobbing of sea level, caused by short duration climate events, causes considerable variability in the locations of paleo-coastlines. In a long Holocene period of general transgressing (landward-moving) coastlines through time as sea level rose, the Younger Dryas and other lesser brief climatic reversals would cause brief regressions (seaward-moving) of the coastline, as they are accompanied by temporary lowering of sea level. Showing the effects of these brief reversals on the coastline is beyond the target resolution of this report. An average position of 40 m was used in the 11,500 BP reconstruction, which represents a time at the beginning of the Younger Dryas event.

Figure 2.20. Composite sea-level curve for the Texas coast (from Anderson et al. 2014). See text for explanation.

## Constructing and validating paleogeography

**MIS 1 rising stage depositional trends.** Three different methods were used to construct paleogeographic maps of the rising stage, depending upon location and proximity to individual areas of continued MIS 1 deposition on the modern continental shelf. In particular, a significant effect on local depositional patterns and hence paleogeography derives from the carrying capacity of the various rivers emptying into the study area—related in part to the size and topographic relief of their drainage basins. The Mississippi, Brazos, and Colorado rivers drain


Age (calibrated yr B.P.)
Depth (mbsl)
0.4 to 0.6 mm/yr
1.4 mm/yr
4.2 mm/yr
Swash zone (Milliken et al., 2008a)
Linear Regression and 95% Confidence Interval
Coral (Toscano and Macintyre, 2003)
Linear Regression and 95% Confidence Interval
Peat (Törnqvist et al., 2004a, 2004b, 2006)
Linear Regression and 95% Confidence Interval
Peat (Milliken et al., 2008a)
Peat (Milliken et al., 2008a)
Swash zone with laminations (Milliken et al., 2008a)
Algal Mats (Livsey and Simms, 2013)

basins that are an order of magnitude larger in area than those of the San Jacinto, Sabine, and Trinity (Figure 2.21). Moreover, those larger rivers (in yellow) reach into the mountainous interior of the continent, whereas the smaller rivers (in blue) drain only the flat coastal plain and surrounding rolling plains. The large arrows on Figure 2.22, a shaded relief map of the MIS 2 unconformity surface, roughly indicate the variability in the suspended sedimentary load of these rivers, as per Blum and others (2013). The Brazos and Colorado systems—and the Mississippi, just east of the study area—contained sufficient suspended sedimentary load during drying Holocene climate to fill their Pleistocene incised valleys in the coastal region and form significant deltas on the shelf during rising sea level (brown shading, Figure 2.22). In contrast, the Holocene discharge and suspended sediment load of the smaller rivers (Calcasieu, Sabine, Trinity/San Jacinto, Lavaca, Nueces, etc.) is relatively small, and in general these rivers only form small bayhead deltas that are confined to updip positions of their Pleistocene incised valleys. Their distal incised valleys remained unfilled with sediment, only receiving small bayhead delta, open bay, and tidal delta fill as seas transgressed during sea level rise (Anderson et al. 2016).

The broad flat plain surrounding these smaller rivers was continually exposed during the Late Pleistocene and early Holocene, until rising sea level buried it. For this reason, a good approximation of the paleo-coastline for that region (areas of the modern shelf that are not shaded brown in Figure 2.22) can be obtained by projecting the elevation of sea level at a particular time onto the MIS 2 contour map. Paleo-coastlines corresponding to 22,000 BP, 14,500 BP, 13,000 BP 11,500 BP, 10,000 BP, 9000 BP, and 7000 BP are shown in Figure 2.22. They document the

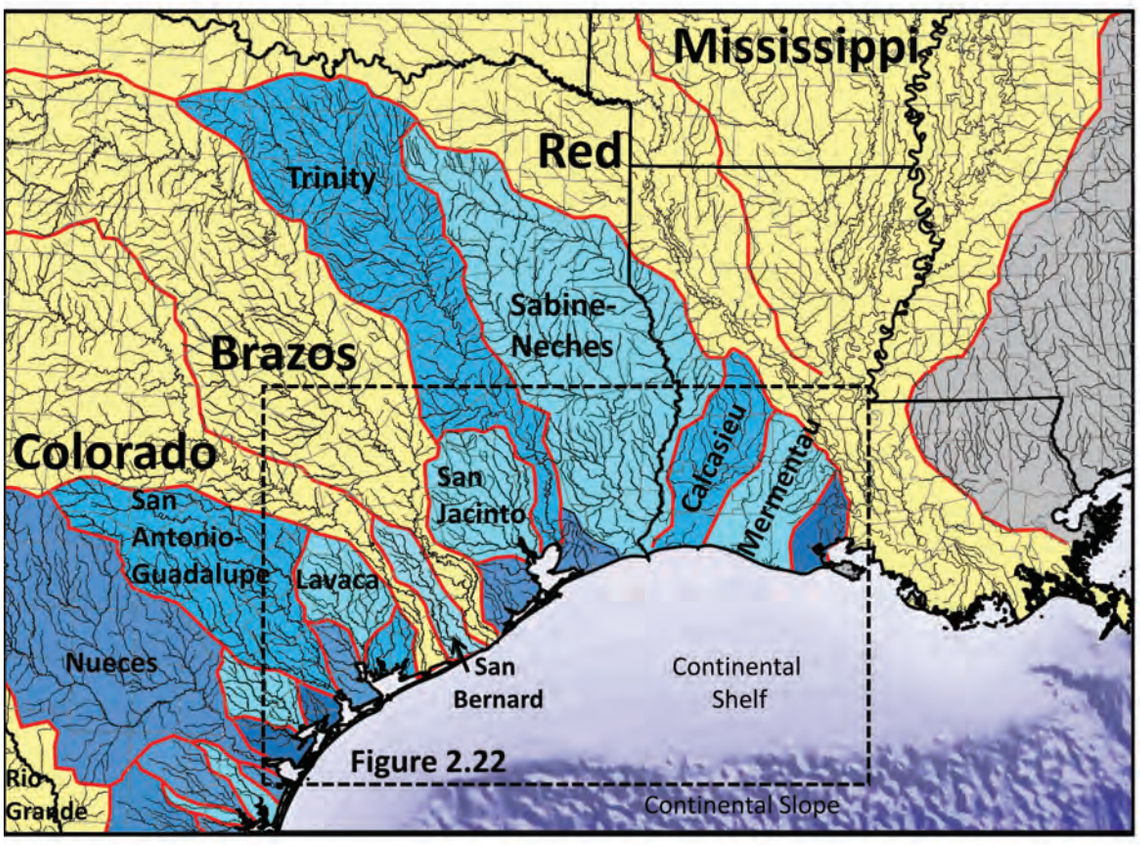



Figure 2.21. Drainage basins of east-ern Texas and western Louisiana. The Mississippi, Red, Brazos, Colorado and Rio Grande drainage basins (yellow) dwarf all other drainage basins (blue) in terms of their area and their reach into mountainous source areas of the interior. Dashed line shows location of map in Figure 2.22 and the paleogeographic maps of Atlas I.

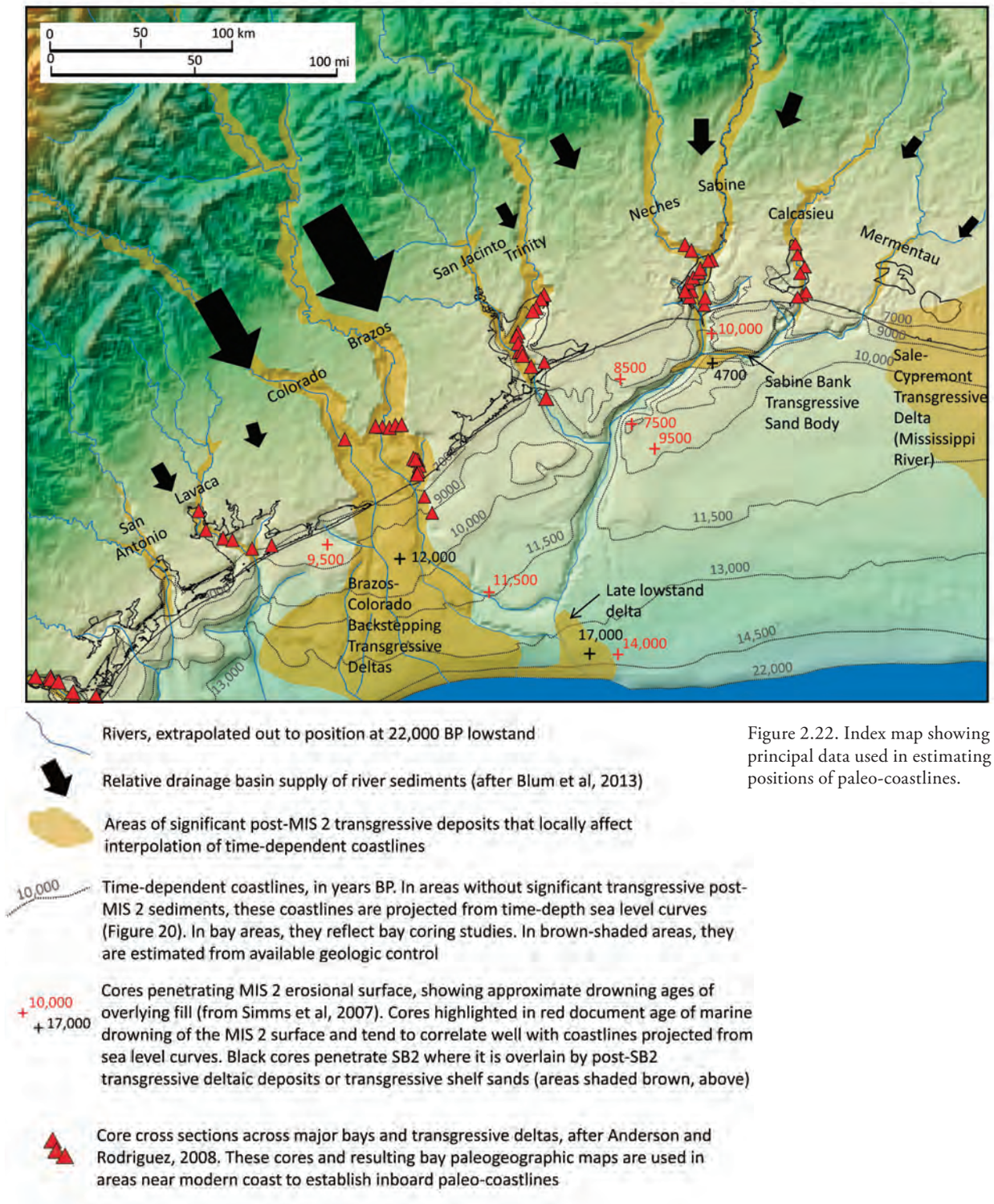

0 50 100 km
0 50 100 mi
Sabine
Neches
Calcasieu
Mermentau
San Jacinto
Trinity
Brazos
Colorado
Lavaca
San Antonio
10,000
8500
4700
Sabine Bank Transgressive Sand Body
7000
9000
10,000
Sale-Cypremont Transgressive Delta (Mississippi River)
7500
9500
11,500
9,500
12,000
11,500
13,000
Brazos-Colorado Backstepping Transgressive Deltas
Late lowstand delta
17,000
14,000
14,500
22,000
13,000
Rivers, extrapolated out to position at 22,000 BP lowstand
Relative drainage basin supply of river sediments (after Blum et al, 2013)
Areas of significant post-MIS 2 transgressive deposits that locally affect interpolation of time-dependent coastlines
10,000
Time-dependent coastlines, in years BP. In areas without significant transgressive post-MIS 2 sediments, these coastlines are projected from time-depth sea level curves (Figure 20). In bay areas, they reflect bay coring studies. In brown-shaded areas, they are estimated from available geologic control
10,000
17,000
Cores penetrating MIS 2 erosional surface, showing approximate drowning ages of overlying fill (from Simms et al, 2007). Cores highlighted in red document age of marine drowning of the MIS 2 surface and tend to correlate well with coastlines projected from sea level curves. Black cores penetrate SB2 where it is overlain by post-SB2 transgressive deltaic deposits or transgressive shelf sands (areas shaded brown, above)
Core cross sections across major bays and transgressive deltas, after Anderson and Rodriguez, 2008. These cores and resulting bay paleogeographic maps are used in areas near modern coast to establish inboard paleo-coastlines

Figure 2.22. Index map showing principal data used in estimating positions of paleo-coastlines.

steady drowning of the modern continental shelf by advancing seas.

Offshore coring results provide an independent check on the accuracy of these projected coastlines. These cores are shown as red crosses on the figure, and the adjacent numbers indicate the approximate drowning age (arrival of marine conditions with rising sea level) obtained from the cores. In most cases, the cores indicate drowning ages that agree with projected coastline locations. Each is discussed later,

with corresponding paleogeographic maps.

The areas with significant transgressive fill—sedimentation that preceded the arrival of a paleo-coastline (brown shading on Figure 2.22)—are treated differently with regard to estimated paleogeography. A cross-valley coring transect and profile of the Colorado and Brazos incised valleys (Figure 2.23) shows that these deep valleys were about one third full of river-carried alluvium by 12,000 BP, and were completely full by about 5,000 BP. During this time their combined delta back-stepped westward across the shelf as sea level continually rose, leaving behind a thin nonmarine and shallow marine delta complex on the modern shelf (Anderson et al. 1996: Fig. 7). A core taken through this delta, reaching the underlying MIS 2 erosional surface, yielded an age of 12,000 BP for the sediments above the unconformity (Simms et al. 2007; black cross on Figure 2.22). That core date probably reflects the local arrival of deltaic sediments into a partly filled Brazos-Colorado channel system. Similarly, a 17,000 BP date within a 30 m thick transgressive packet at the foot of the Brazos-Trinity system (black cross on Figure 2.22) probably reflects a late lowstand or early rising stage transgressive delta on the shelf margin (Anderson et al. 1996: Fig. 6). In the eastern portion of the study area, a deltaic lobe of the Mississippi River system, the Sale-Cypremont Transgressive Delta, arrived around 7,500 to 5,000 BP (Berryhill et al. 1986; Coleman et al. 1998). A number of separate transgressive sand bodies were mapped by Berryhill and others (1986) on the Louisiana shelf trending into East Texas. One of them, at Sabine Bank, was cored by Rodriguez and others (1999), showing that an estuarine deposit as young as 4,700 BP was overlain by shoreface sands of a small barrier island (black cross on Figure 2.22). These deposits directly overlie Pleistocene strata beneath the MIS 2 erosional surface.

**Bay coring studies**. Areas along existing bays and estuaries (Corpus Christi, Lavaca, Trinity/Galveston, Sabine, and Calcasieu) have been extensively cored, and

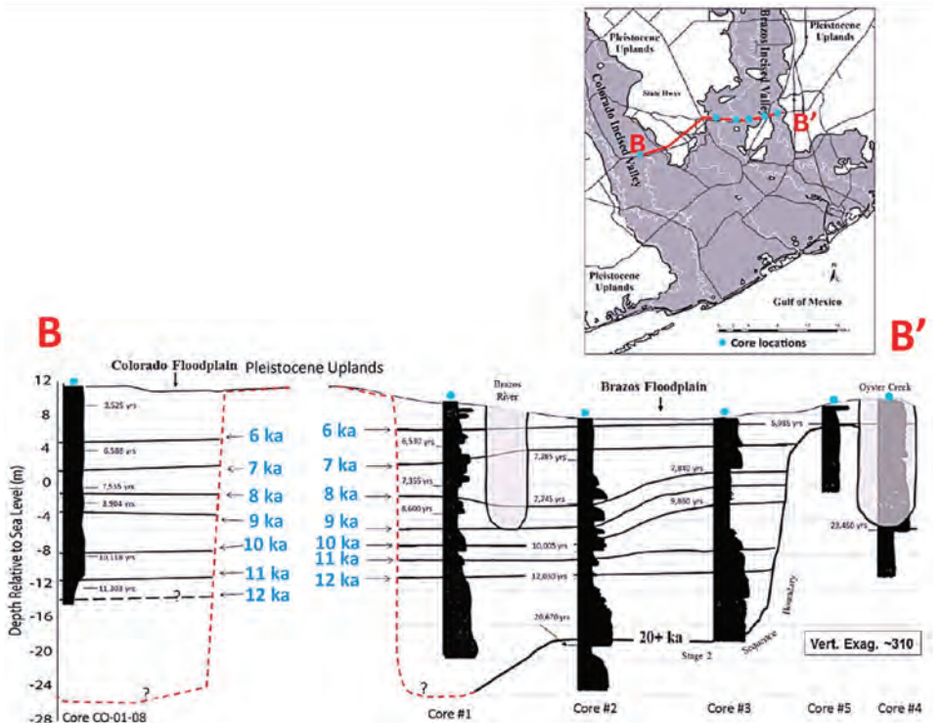



Figure 2.23. Cross-valley profile for the Colorado and Brazos valleys; location shown on inset map. Blue numbers on profile represent sedi-ment ages from radiometric dates of cores, in thousands of calibrated years BP. Heavy black lines adjacent to those numbers are levels of equal age. The valleys were incised (excavated by erosion) during the last glacial maximum, ca. 22,000 BP, and the lower third of the valleys' subsequent fluvial fill was deposited by 12,000 BP. The valleys were mostly filled by about 5,000 BP. At some time later, the lower, coastal Colorado River avulsed (left its former incised chan-nel) and moved southwestward. From Anderson and others (2016, from data of Taha and Anderson 2008).

individual paleogeographic reconstructions were made of each bay, as reported by Anderson and Rodriguez (2008a). Full use was made of these suites of detailed maps in producing the paleogeographic map of the Texas coast reported here. Each of these bays is associated with low-sedimentary-load small rivers with under-filled incised valleys, as discussed earlier, and the studies determine the position of small bayhead and tidal deltas in each valley, as well as local coastlines, through time.

One or more core transects were made for each bay, as shown in Figure 2.22 (red triangles). An example north-south core section, for Galveston Bay, is shown in Figure 2.24. The sedimentary fill from each core was characterized by facies: fluvial (nonmarine) sand; deltaic sand, silt and mud; marine bay mud; and tidal deltaic. Multiple radiometric dates were obtained for each core, and these were correlated to produce lines of equal age that cut across facies (e.g., the four black lines drawn across the north-south transect). From such isotime lines, as well as other available geologic control, Anderson and others created a series of small paleogeographic maps for Galveston and each of the other bays (Figure 2.25). These maps show both the interpreted paleo-coastlines and the geographic extent of various depositional environments (Anderson and Rodriguez 2008a; Anderson et al. 2008b).

In general these maps show each bay evolving from narrow valleys with fluvial deposits (Figure 2.25, first frame) to a widening marine bay as seas encroach on the partly filled valley (also see east-west transect, Figure 2.24). Flooding of these bays occurred not as a purely continual rise but as a series of pulses that caused locally dramatic up-valley shifts in coastlines. These shifts, while of great local interest to communities anticipating the effects of rising sea level today, are of higher resolution than the target of this regional study; readers are referred to the bay studies for more detail.

Figure 2.24. Two cross sections across Galveston Bay, made from core tran-sits. Upper left, index map showing core transits in Galveston Bay (red triangles) and locations of the two cross sections. Lower cross section extends in a north-south direction along the length of the bay, parallel to the buried axis of the Pleistocene Trinity River channel. Locations of cores and calibrated radiometric dates are shown. Four dark lines show time-correlative surfaces that connect equal ages among the core sections. The upper cross section extends perpendicularly across the Trinity channel. Note how the bay begins as a narrow fluvial channel, then expands outward with time. Also note the buried Deweyville terraces that define the channel. From Anderson and others (2008, 2016).

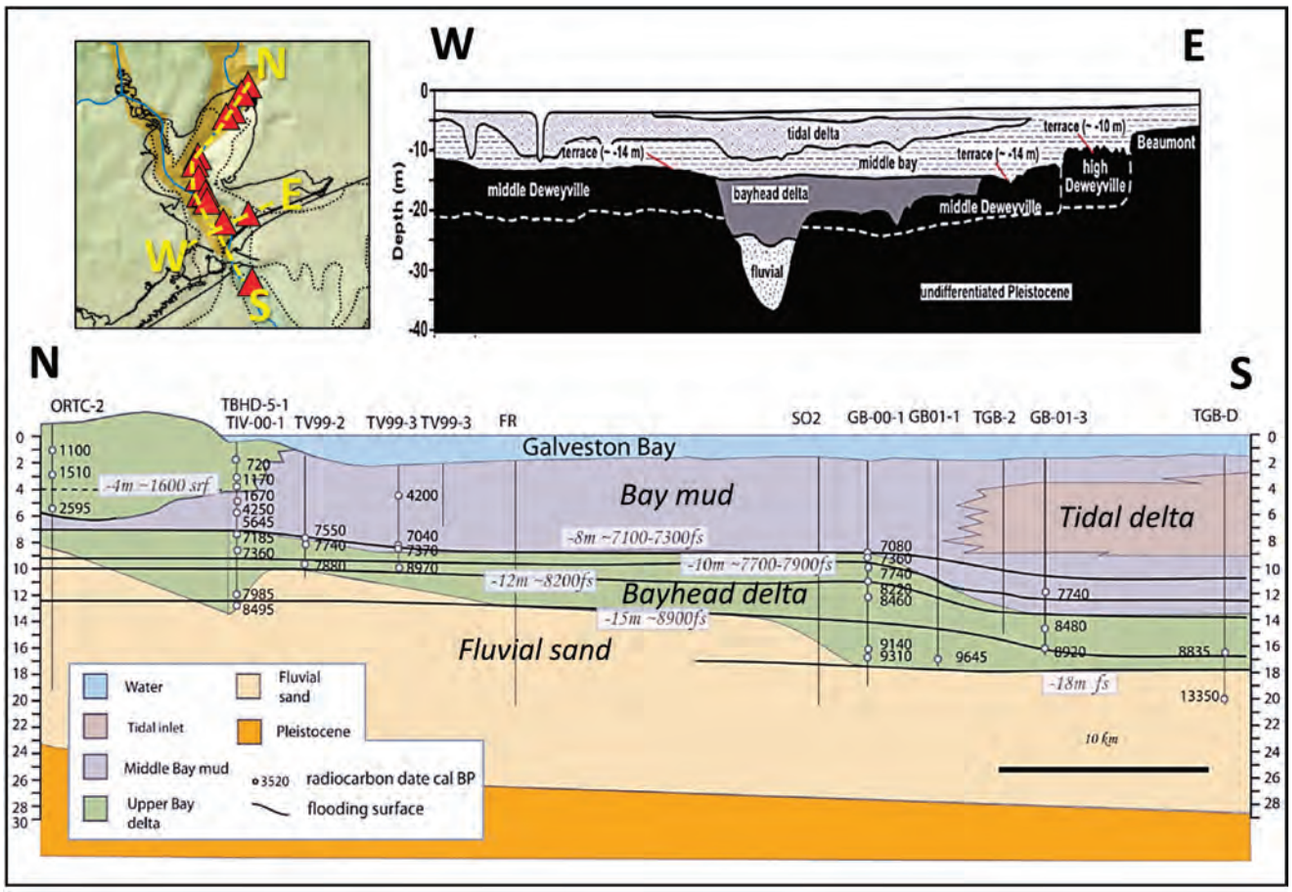
## Paleogeographic maps of the upper Texas coast

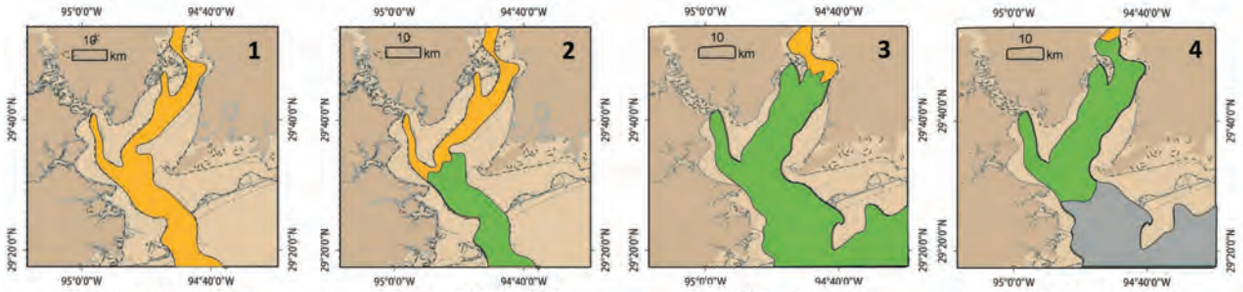
The MIS 2 structure map, the data from the compiled sea level curve, available core data, and the bay maps were synthesized within a seismic workstation in order to provide a set of three-dimensional surface models for significant stages in the area's prehistory. We used the data and the Tornado workstation of the CGG geoscience company (Houston) to generate seven three-dimensional models, for times of 0, 3,000, 5,000, 7,000, 13,000, 14,500, and 22,000 BP; five of these are shown in Figure 2.26. Coastlines for an additional two time intervals (12,500 and 16,000 BP) were interpolated. The software allowed finer-scale edits of facies models and interpretations to be added, and then checked against each adjacent older or younger model for consistency.

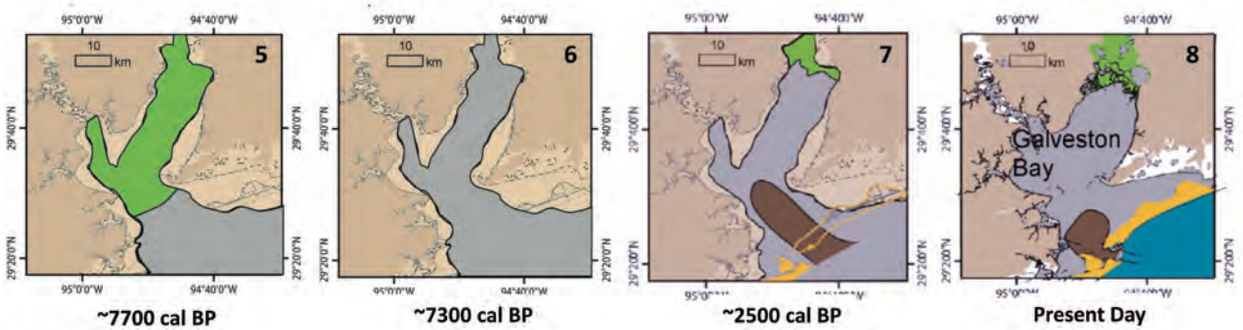
These models were then turned into flat maps with shaded relief (Atlas I, p. 46). Frame A contains county and maritime boundaries as well as river names, for reference; those location references are left out of the subsequent maps for simplicity. All maps contain the location of the modern shoreline, however, for comparison purposes.

**22,000 BP** (Late Pleistocene Epoch, Upper Paleolithic Period, Last Glacial Maximum; sea level -125 m relative to today; Frame B of Atlas I). This is a shaded relief map of the model for the time of maximum lowstand, when sea level was 125

Figure 2.25. Eight paleogeograph-ic maps, made from core studies (see previous figure) and from the structure map of the MIS 2 ero-sional surface (Figure 2.17), which show the Holocene development of the Galveston estuary complex and bay. The four pairs of maps are each built before and after each of four time-correlative surfaces shown on the previous figure. These paleogeo-graphic maps, as well as those from other bays and estuaries of coastal Texas and southwestern Louisiana shown in Anderson and Rodriguez (2008a), form the basis for the near-shore portions of the paleogeographic maps of the present report. Maps from Anderson and others (2008b).




Pleistocene Uplands
Pleistocene Inundated
Pleistocene/Holocene fluvial
Holocene Deltaic
Holocene Bay
Holocene Tidal
Holocene Beach or Chenier Ridges
Holocene Offshore Marine

m lower than today. Note the position of the modern shoreline, included as a thin gray line highlighted by an arrow on both Frames A and B, relative to the Late Pleistocene coastline, nearly 100 miles southeast of the mouth of the modern Brazos River. With a humid glacial climate, the rivers were carrying more sediment and the Colorado and Brazos rivers were discharging sediment-laden turbidity flows and slides down the continental slope (see Figure 2.14). Rivers on the modern Louisiana shelf, shaded light gray, are schematically included but as mentioned, there are no structura contours for them that allow shaded relief. The Brazos San Jacinto, Trinity, Calcasieu, and Mermentau rivers occupied a single drainage basin, with its mouth at a broad swale on the shelf margin.

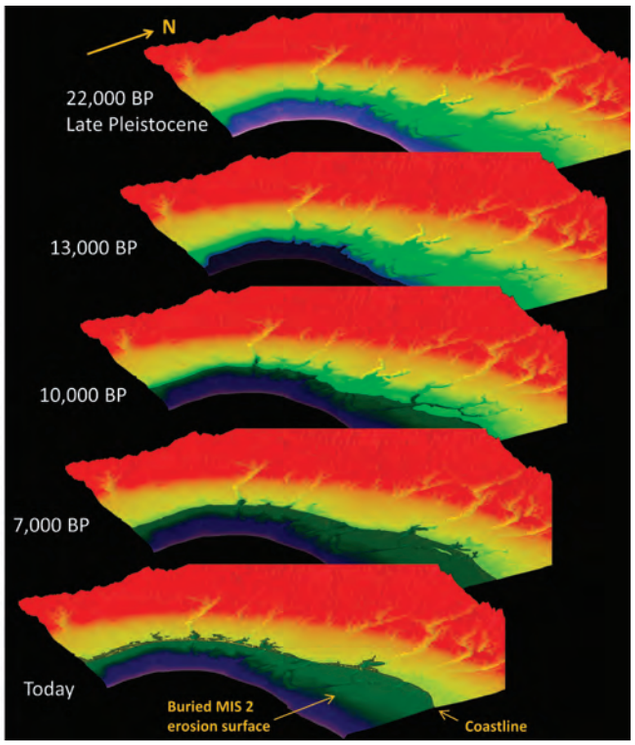



Figure 2.26. Three-dimensional models showing the development of the Texas coast during Late Pleistocene through Holocene time. Vertical exaggeration 150x. For details and labels of topographic features, see Figure 2.18.

**16,000 BP** (Late Pleistocene, Upper Paleolithic Period, -98 m; Frame C). Although sea level had risen 27 m in the intervening 6,000 years, rising at a relatively modest rate of 4.5 mm per year, the shoreline shifted northward only slightly, because of the relative steepness of the edge of the continental shelf. According to coring studies of Pirmez and others (2012), the deepwater turbidite basins on the continental slope just south of the mouth of the Brazos-Trinity were still receiving sediments at this time. There were no substantial bays on a fairly straight coastline at what is today the continental shelf margin. The locations of all modern bays along the Texas–southwest Louisiana coast are eroded inland river valleys, each with as much as 40 m of topographic relief.

By this time, early Native Americans had already colonized Texas, as evidenced by lithic and other remains at the Gault and Friedkin sites in Bell County (Figure 2.1), where early Americans were present as early as 20,000 BP (Williams et al. 2018). The sites rest along a tributary of the Brazos River, and it is not difficult to imagine that these early inhabitants would have travelled to the coast.

**14,500 BP** (Late Pleistocene, Late Paleolithic Period, -93 m; Frame D). Only 1,500 years younger than the previous map, by this time the last of the turbid flows had spilled across the modern shelf margin, signaling a shift to drier conditions and less sediment discharge. The rate of sea level rise was still modest, at about 3.3 mm per year. There were still no bays, and coastal topography sloped steadily toward the coast.

A core that penetrated the MIS 2 unconformity taken by Simms and others (2007: Fig. 16), just inland from the projected coastline (see Frame D), has a drowning age 14,000 BP, which is in good agreement with the projected placement of the 14,500 BP coastline. The sediments beneath the MIS 2 unconformity yielded a date of 28,000 BP, which indicates that this part of the modern shelf was exposed to erosion before being inundated by rising sea level.

**13,000 BP** (Late Pleistocene, Early Paleoindian, -65 m; Frame E). The pace of

sea level rise had quickened to a very rapid rate of about 18 mm per year, and the coastline had begun to move steadily landward. The Brazos and Colorado valleys were filling with river sediment, especially in their lower reaches, where a delta formed. There were no substantial bays, except at the mouth of the Lavaca River. This time period saw the brief rise of Clovis hunters and the last of the Pleistocene megafauna.

**12,500 BP** (end Pleistocene, Early Paleoindian, -45 m; Frame F). Only a brief time later, coastal changes were now rapid, with sea level rising at about 40 mm per year. The lower part of the Trinity-Sabine incised valley, kept relatively open by a relative lack of sediment, started to flood with rising sea level, forming a prominent, elongated bay. The bay that had formed earlier at the mouth of the Lavaca River had broadened considerably. The coastal plain had started to recede rapidly all along the coast. The Brazos and Colorado river valleys continued to fill, and those rivers continued to feed a coastal delta, which also receded (backstepped) as rapid sea level rise continued.

**11,500 BP** (early Holocene, Late Paleoindian Period, -40 m; Frame G). The bay along the lower Trinity-Sabine channel had expanded considerably, with marine conditions reaching past the mouth of the Trinity to near the location of branching of the Sabine and Calcasieu rivers. Sea level rise was still fairly rapid at ~10 mm per year, and the coastline continued to recede. The "average" sea level at 11,500 BP used for the construction of the map is 40 m, but this time interval is one of considerable fluctuation in sea level due to the so-called Younger Dryas glacial event, as already mentioned.

A core sample taken from offshore block GA426 by Evans (2012: core 10) penetrates what appears to be the MIS 2 unconformity. Shell hash and fine-grained sediments overlying the unconformity contained pollen indicative of a grassy wetland. The deepest dated sample above the unconformity, at 1.06 m below sea bottom, yielded a calibrated age range of 11,320 to 11,840 BP; an average age of about 11,500 BP is shown on Frame G (black cross).

**10,000 BP** (Holocene, Late Paleoindian Period, -23 m; Frame H). The single bay along the partly drowned Trinity-Sabine incised channel had now branched into four arms at its headland, each destined to become a separate modern bay or estuary: the Trinity (later to become Galveston Bay), Sabine, Calcasieu and Mermentau rivers. This split has ramifications for human culture that are discussed in Chapter 10. The coastline was highly irregular relative to today, and sea level rise was still rapid at about 15 mm per year since 11,500 BP. The enlarging bay system had isolated a large peninsula, occupied in modern times by the submerged Sabine Bank. A core taken by Simms and others (2007: Fig. 16) showed that the seaward portion of the peninsula had drowned at about 9,500 BP; thus supporting the location of the projected 10,000 BP coastline shown on the map.

Another core, taken at the paleo-mouth of the Sabine River by Pearson and others (1989), penetrated organic- and peat-rich estuarine sediments in the Sabine onshore valley at what is now offshore Block 6 in the shallow offshore waters of westernmost Louisiana. The core overlies a Deweyville terrace within the Sabine valley. The organic-rich sediments at Core 3B yielded a radiocarbon age of 8,800 rcyBP, or about 10,000 BP, as shown on Frame H. The organic-rich zone was overlain by

about 2 m of more estuarine deposits and then about 20 m of marine bay mud. The drowning age was not precisely dated but is younger than 10,000 BP, consistent with the map of Frame H. Pollen samples within the organic zone include grasses and a diverse assortment of trees, indicative of an upland-to-swamp interface appropriate for its paleogeographic setting along the lower Sabine valley at the paleo-coast.

Another core penetration of estuarine, nearshore deposits of this age was taken by Evans (2012) at Offshore Block HI 176 (marked as 9,800 BP on Frame H). A Pleistocene high point apparently representing the MIS 2 erosional surface was penetrated at Core 1 in that block. Sediments overlying the unconformity were fine-grained and included peat and flecks of charcoal. The oldest sample dated to about 9,800 BP, and ranged as young as about 7,875 BP, showing that the area was nonmarine during that time interval. These sites are overlain by about 2 m of marine mud and shell hash signifying a drowning that occurred after 7,875 BP. Pollen from the organic-rich zone indicates that the area was a coastal meadow, with mixed trees in the vicinity.

Farther west, the Colorado and Brazos rivers continued to fill their incised valley and supported a delta at the coast.

**9,000 BP** (Holocene, beginning Early Archaic, -15 m; Frame I). The rate of sea level rise was moderating, from about 8 mm/yr at 10,000 BP to 4.1 mm/yr by 8,000 BP. Rising seas were beginning to form estuaries at the locations of modern Galveston Bay, Sabine Lake, Calcasieu Lake, and the Mermentau River estuary. The large peninsula on the previous map at modern Sabine Bank had separated into two islands, the larger Sabine Bank and the smaller Heald Bank. Heald Bank is the site of a core that penetrated Pleistocene clay underlying the MIS 2 surface. The erosional surface is overlain successively by beach sands and shell hash, shallow water marine sands and muds, and marine mud, established a drowning date of 7,500 BP (J. B. Anderson et al. 2014:.8, Fig. 8), as shown on the map. Across the bay to the north, a penetration of the MIS 2 surface by Simms and others (2007) revealed a drowning age there of 8,500 BP, validating the projected sea level on the paleogeographic map. The core site marked with a drowning age of about 7,900 BP is the Offshore Block HI 176 site of the organic-rich meadow cored by Evans (2012), as discussed for the previous map. Marine transgression followed the deposition of the youngest nonmarine sediments dated there. By 9,000 BP, that area was an isolated headland.

The location of modern Galveston Bay was still the site of an incised valley, holding a very narrow band of nonmarine fluvial deposits along the course of the Trinity River (FIgure 2.25, Frames 1 and 2). The Brazos and Colorado incised valleys continue to fill with fluvial sediments onshore, and their sedimentary discharge continues to support a small wave-dominated delta.

Sediment cores from Mustang Island have yielded radiocarbon ages indicating that the shoreline was near its present location by 9,500 BP (Simms et al. 2006). At that time the barrier was low and subject to frequent breaching and over-wash.

**7,000 BP** (Holocene, end Early Archaic, -7 m; Frame J): By this time the rate of sea level rise had slowed dramatically, from 4.2 mm to 1.4 mm per year (Fig. 2.20), and the modern Texas coastline began to take shape. Sea water had filled much of modern Galveston Bay as the old incised valley was further drowned. A bay head delta filled the upper portion of the Trinity River channel with sediments, as shown

by the flat area north of Galveston Bay in Frame J (Anderson et al. 2008b). Similar bays had formed at the Sabine and Calcasieu river mouths, where their respective rivers were also filling in parts of their updip channels with sediment, forming bay head deltas (Milliken et al., 2008b, 2008c). Sabine Island at this time was a barrier island, made up in part of sand derived from the former Sabine Peninsula; it was drowned by 4,700 BP (J. B. Anderson et al. 2014:8, their Fig. 8).

Farther south along the Texas coast, the shoreline of Matagorda Peninsula was located about 2 km landward of its current location (Maddox et al. 2008), and Matagorda Bay and Corpus Christi Bay were close to their current size and location, so the central Texas coastline was leading the upper Texas coast in reaching its current configuration.

**5,000 BP** (Holocene, end Middle Archaic, -4 m; Frame K). The rate of sea level rise continued to slow, reaching only 1.4 mm per year. Galveston Bay, which overlies the former Trinity River incised valley, was nearly in its present shape, and Bolivar Peninsula and Galveston Island began to form as spits along the seaward edge of the bay (Rodriguez et al. 2004). Sabine Bay was nearly as large as Galveston Bay. Offshore, Sabine Island was nearing its life span, about to be drowned at 4,700 BP, as discussed earlier.

The Brazos and Colorado incised channel was by now completely filled, leaving no surface expression of its existence. Because of that, both rivers are no longer confined to their incised valleys, and the Colorado River avulsed to a position farther down the coast, either during this time period (as shown) or soon after; the modern Colorado river mouth is in Matagorda Bay, a back-barrier island bay that had not yet formed by this time.

**3,000 BP** (late Holocene, Late Archaic, -2m; Frame L). The rate of sea level had continued to slow, to an average rate of 0.5mm per year. The coastal bays continued to enlarge, albeit slowly. Sabine and Calcasieu bays were still open to the sea. Galveston Island had grown to about one half its current size. The central Texas coastline and bays were pretty much in their current form by this time, although the coast fluctuated in its location on the order of a few kilometers in response to variations in sediment supply and expansion of the offshore Texas Mud Blanket, a broad area of fine-grained mud deposited on the central and South Texas shelf (Rodriguez et al. 2001).

**0 BP** (today, 0 m; Frame M). The rate of sea level rise continued at a low rate (average of 0.5 mm/yr) as the peak of the interglacial warming—the end of the glacial cycle—neared, from ~3,000 BP to today (Figures 2.5 and 2.20). On the Louisiana and far east Texas coast, the development of chenier ridges— beach sand ridges that accrete southward—caused the coastline to move basinward, in contrast to the previous trend. These ridges have infilled the mouths of Sabine and Calcasieu bays, forming modern Sabine Lake and Calcasieu Lake (Milliken et al. 2008a, 2008b) as well as White and Grand Lakes in the Mermentau River area.

## Back to the future?

The map of Frame M brings us to the end of our review of the last glacial cycle, which began at the time of an interglacial warm period 120,000 years ago. But are

we yet at the very end of that cycle? Because the past 22,000 years of Texas coastal history have seen nearly continuous sea level rise, one might well ask how much more sea level might rise in the future, if we are not yet at the end of the cycle.

One approach to addressing this question is to observe the extent to which high sea level rose at the end of the last cycle, and how far inland the shoreline was then, relative to that of today. A review of the last interglacial highstand period (LIG), which peaked at 120,000 BP (labelled "C" on Figure 2.5), suggests that we may have a way to go before sea level "tops out" and glaciation begins anew. Scientists have estimated that sea level at the LIG was between 6 m and 9 m higher than today (Figure 2.27, taken from the work of Dutton and Barlow 2019; also see Simms and others 2013: 297; and see our Figure 2.5).

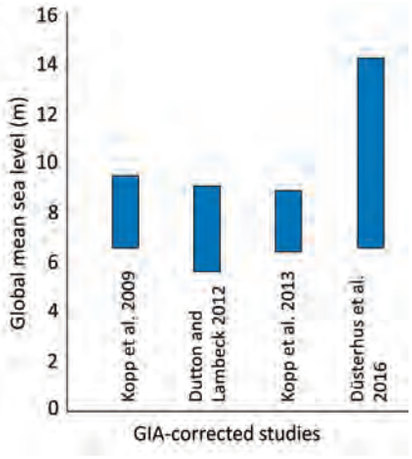



Figure 2.27. Estimates of how much higher sea level was during the last interglacial (during the global mean sea level highstand) than it is today . The bars represent a range of uncertainty. The studies include a glacial isostatic adjustment (GIA). Modified from Dutton and Barlow (2019).

On the Texas coast the shoreline at the time of the LIG is represented by the Ingleside shoreline, associated with a prominent ridge of beach sand (a geologic marker of a past coastline location) that is considerably inland of the modern coast (see the earlier discussion accompanying Figure 2.9). It marks the highstand of the last glacial cycle in Texas and Louisiana (Otvos and Howat 1996; Simms et al. 2013b). The geology of the Ingleside shoreline and adjacent coeval back bay and marine strata was mapped by Winker (1979, 1990), and largely from Winker's map a paleogeographic map of the LIG has been prepared (Atlas I, Frame N; also see Figure 2.9). The elevation of the 120,000 BP Ingleside shoreline varies from 1 m to 8 m higher than today's sea level, according to Simms and others (2013a, 2013b). In addition to the effects of surface erosion, this variation has been attributed to gentle regional warping due to land subsidence, from both sedimentary loading and subsurface fluid extraction (especially groundwater from wells). Nonetheless, the paleogeography of that shoreline relative to that of today indicates what order of magnitude of sea level rise remains in store for the Gulf Coast.

There are several components to understanding the total change in both sea level and coastline position that will likely be seen along the upper Texas coast in coming centuries. These include (1) changes in global sea level, (2) changes in the rate of sea level rise as the end of the cycle is approached, and (3) the amount of land subsidence along the coast, which exacerbates the local effect of rising sea level.

(1) Expected changes in global sea level. Given current changes in the Greenland and West Antarctic ice sheets, it is logical to expect another 4–9 m of global sea level rise before the current interglacial condition culminates (Rignot et al. 2011; DeConto and Pollard 2016). The fastest and highest sea level rise is projected to occur by 2500–3000 AD as a result of collapse of the marine-based sectors of the Antarctic ice sheet (Golledge et al. 2015; DeConto and Pollard 2016).

(2) Changes in the rate of sea level rise. Results from tide gauge analyses and satellite altimetry data provide compelling evidence that the current rate of sea level rise averages ~3.0 mm/yr (Church and White 2011; Rahmstorf et al. 2007; Rignot et al. 2011). This is much higher than the average of about 0.5 mm/yr measured from 3,000 BP to present discussed earlier, and matches that experienced along the coast at 7,000 BP, when the rate of sea level rise was significantly higher. Many scientists have suggested that this rate change is due to human-imposed effects on cli-

mate. That change, by itself, would result in a rise of nearly 0.3 m by the end of the century. The National Oceanographic and Atmospheric Administration (NOAA), as part of its Fourth National Climate Assessment of 2017, concludes that the current rate of rise of ~3.0 mm/yr will continue to increase in the future, and that by the end of this century global sea level will increase from 0.3 m to 1.2 m or more (Sweet et al. 2017).

(3) Effects of land subsidence. Within the northwestern Gulf of Mexico, the effects of this change in the rate of sea level rise upon the position of the coastline is exacerbated by relatively high rates of land subsidence, which can be as high as 10 mm/yr (Paine 1993; Kolker et al. 2011). The combined effects of current sea level rise (3 mm/yr) and land subsidence (up to 10 mm/yr) amount to a six-fold increase in the rate of rise indicated by sea level curves for the past few millennia (Fig. 2.20), and are consistent with results from the U.S. East Coast (Englehart et al. 2011; Kemp et al. 2011).

Current measured rates of shoreline change in Texas, which reflect the combined factors of sea level rise and land subsidence, vary along the coast but are on average ca 1.6 m/yr along the upper Texas coast, ca 0.3 m/yr along the central Texas coast, and ca 1.9 m/yr along the south Texas coast (Gibeaut et al. 2006; Paine et al. 2012). This current rapid rate of shoreline retreat is unprecedented in historical time. For example, at these current rates of shoreline retreat, and given the ages of the barrier islands, the shoreline today would be situated kilometers inland of its current location along the upper and south Texas coast if this rate had occurred since barrier island formation. Wallace and Anderson (2013) provide documentation for this unprecedented change at Galveston Island. Looking forward, Odezulu and others (2018) demonstrate that, at its current rate of retreat and washover, Follets Island will cease to exist as a subaerial barrier within three centuries. The same appears to be true for Matagorda Peninsula and South Padre Island. Thus the scientific evidence indicates (1) that sea level rise has accelerated in historical time, and the current rate of sea level rise in the western Gulf now matches the rate prior to 7,000 BP; (2) land subsidence due primarily to subsurface fluid extraction has had an even larger effect on coastline change than sea level rise; and (3) current rates of coastline retreat along the upper and south Texas coasts are more in line with those rapid rise conditions that occurred prior to 7,000 BP.

## Summary

This chapter has reviewed the geologic and geographic development of the Texas coast during the last glacial cycle, from 120,000 BP to present, and produced a set of paleogeographic maps for the 22,000-year duration of sea level rise since the Last Glacial Maximum. The paleogeographic maps are intended as a base for mapping of activities of coastal Native Americans, as gleaned from archeological studies (Chapter 10).

During the last glacial cycle the Texas coast went from one of relative quiescence during the 120,000 BP highstand, with high sea level, drier and warmer conditions, and sluggish rivers, to a 22,000 BP lowstand where swollen rivers in a cooler and wetter climate carried relatively large loads of sediments past a relatively steep

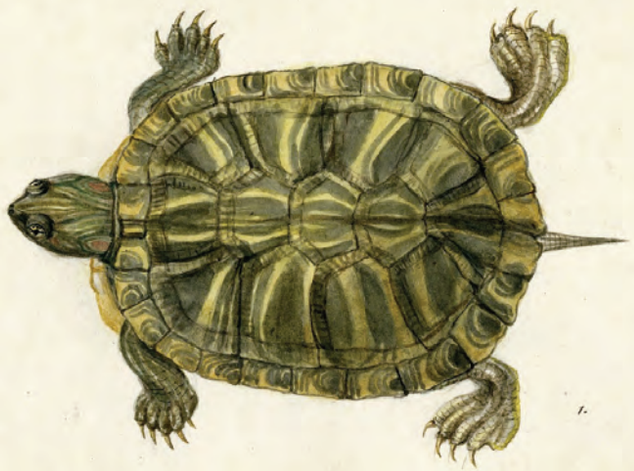
coast into deep water, hundreds of miles farther out into the shelf at the modern shelf margin; and sea level was 125 m lower than present. Then, as climate warmed yet again from 22,000 BP to today, the Texas coast returned to a state of relative stability, characterized by (1) sea level rise that was a fraction of a mm/yr, (2) rivers that are relatively sluggish and at a low point in terms of their long-term sediment discharge, and (3) a coastline that was either stable or advancing seaward. During historical time, the rate of sea level rise has increased nearly six-fold, which, coupled with limited sand supply to the coast, has resulted in a renewed phase of accelerated coastal change. As our maps and sea level curve depict, this current rate equates to the rate that occurred prior to 7,000 years ago, a time when coastal change was occurring at high rates.

By the time of the LGM, when sea level was low and the modern shelf was dry land, the San Jacinto, Trinity, Sabine, Calcasieu, and Mermentau rivers were confined to incised river valleys and joined together in a single drainage basin. Near the paleo-coastline, they joined the Brazos River, which carried relatively high sediment loads to the coast and discharged them as turbidites on the nearby deepwater slope. Higher sedimentation rates of the Brazos and Colorado River resulted in the construction during the following sea level rise of an earlier formed shelf-edge delta, which back-stepped (moved landward) across the shelf and filled in the former incised valley with clastic sediments. As a result of its higher sediment supply, no substantial bays formed in the Brazos valley; fluvial sediments filled the valley in pace with sea level rise. The Trinity, Sabine, Calcasieu, and Mermentau rivers drained much smaller basins than the Brazos, and as a result their valleys were underfilled and formed no large deltas at the coast. At about 12,500 BP, as the climate became warmer and drier, rising seas began to drown significant parts of their combined incised valley, forming an elongate single inland bay. By 9,000 BP, four separate bays had formed along their drowned river valleys as sea level continued its rise. By about 7,000 BP, the rate of sea level rise began to slow, and by 5,000 BP modern barrier islands began to form, and the present position of the modern coastline began to take shape.

Watercolor of a young Texas Tortoise (*Testudo bicolor*), from the work of French naturalist Jean Louis Berlandier, who visited the Gulf Coast of northeastern Mexico and Texas in 1830. Image courtesy of the Smithsonian Institution Archives.

*Chelonii* *Pl. IV.*

*Fam. Cryptopodi*

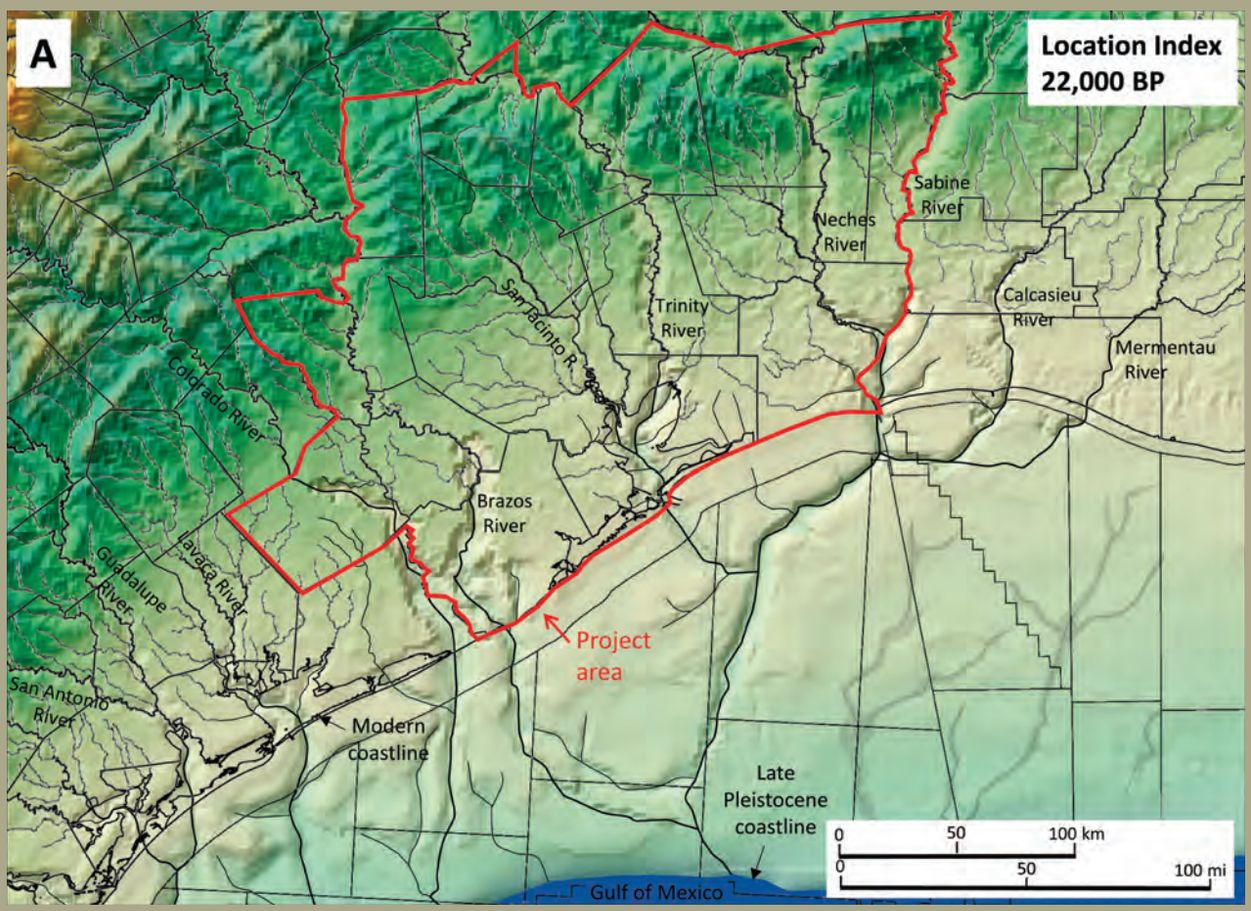


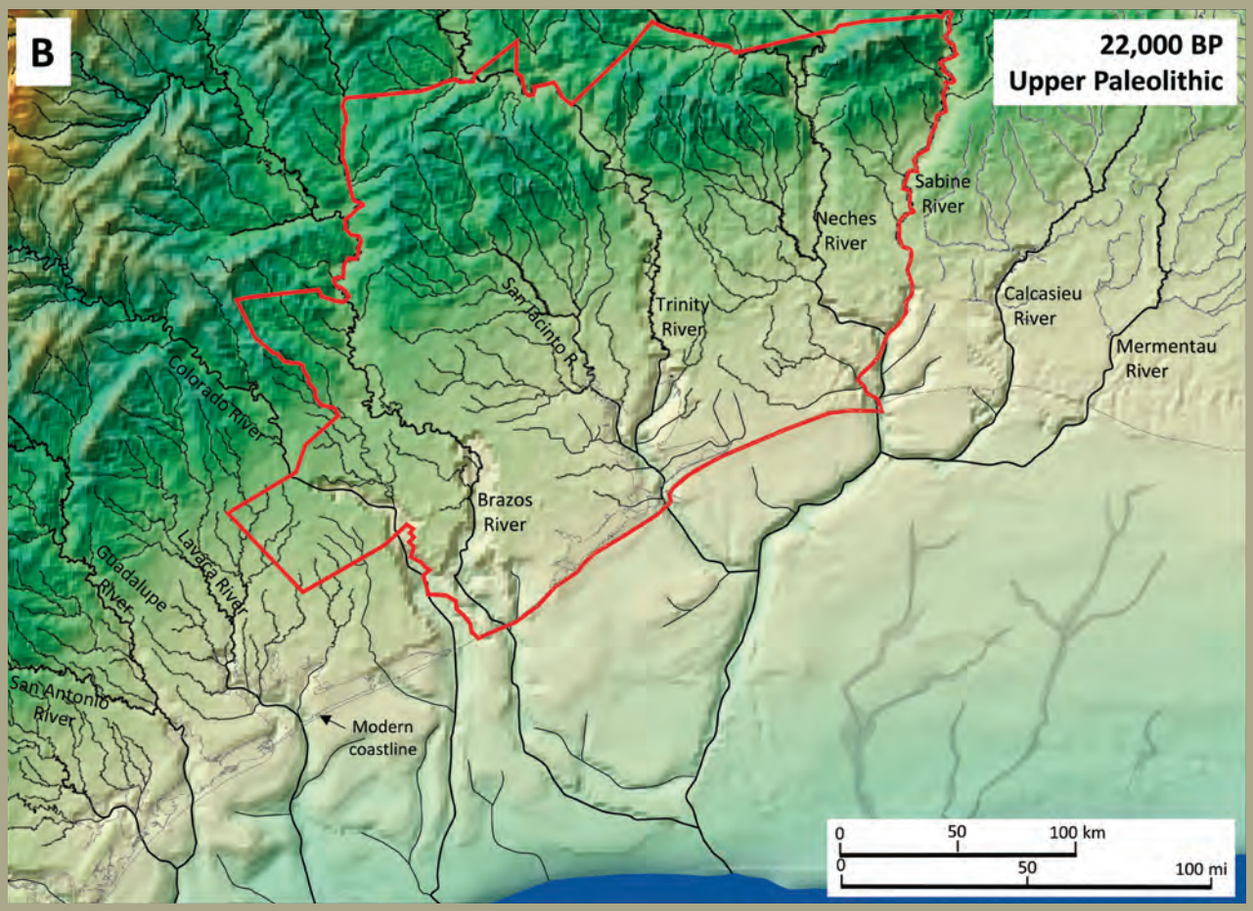
= *Emys bicolor* Bed. mss.

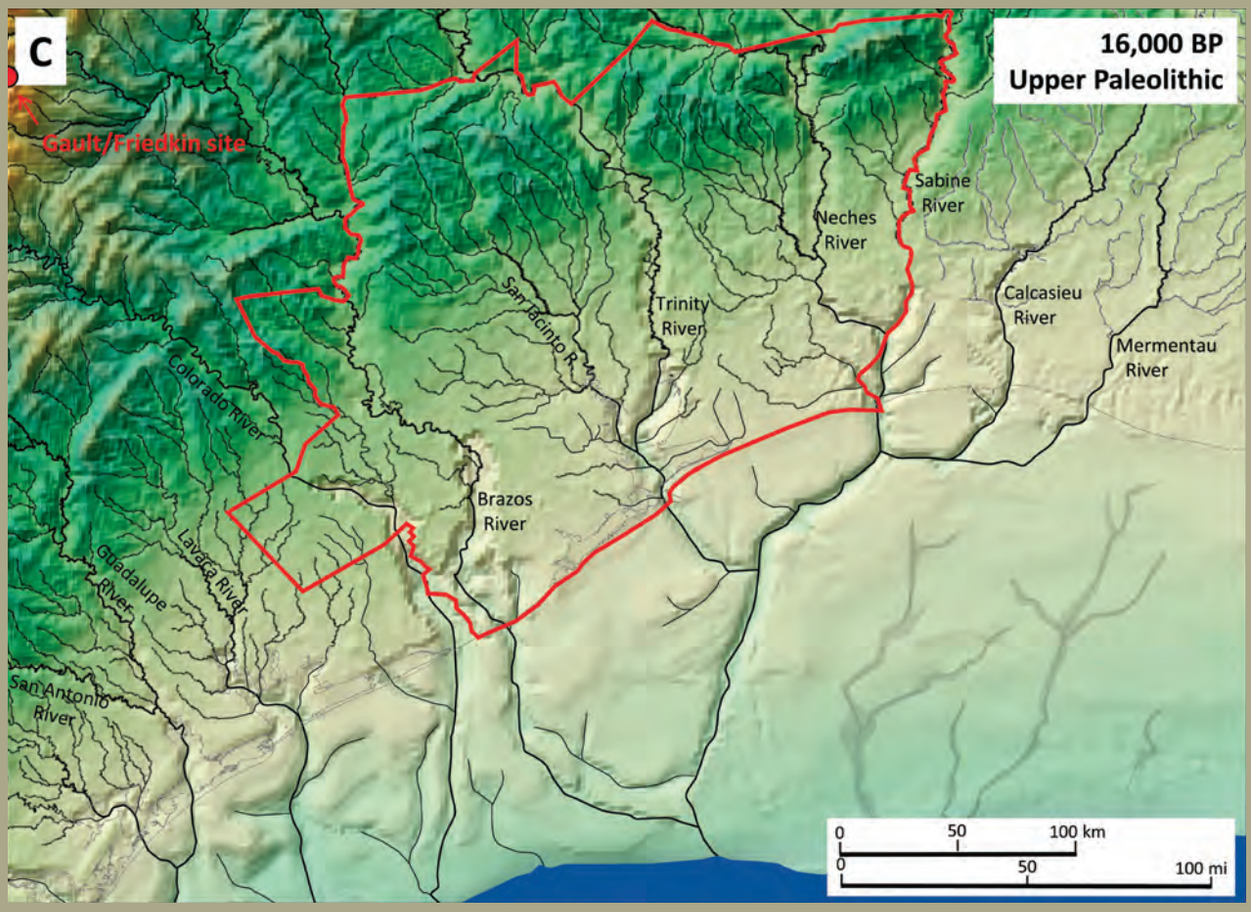
*in campis et aquis dulcis prope Montamoros usque ad Pampam in Tamaulipas.*

# Atlas I:

# Paleogeographic reconstructions of Southeast Texas, 22,000 BP to present




B
22,000 BP
Upper Paleolithic
Sabine River
Neches River
Trinity River
San Jacinto R.
Calcasieu River
Mermentau River
Colorado River
Brazos River
Lavaca River
Guadalupe River
San Antonio River
Modern coastline
0 50 100 km
0 50 100 mi


C
16,000 BP
Upper Paleolithic
Gault/Friedkin site
Sabine River
Neches River
Trinity River
San Jacinto R.
Calcasieu River
Mermentau River
Colorado River
Brazos River
Lavaca River
Guadalupe River
San Antonio River
0 50 100 km
0 50 100 mi

D
14,500 BP
Upper Paleolithic
Sabine River
Neches River
Calcasieu River
Mermentau River
Trinity River
San Jacinto R.
Colorado River
Brazos River
Lavaca River
Guadalupe River
San Antonio River
14,000
0 50 100 km
0 50 100 mi

E
13,000 BP
Early Paleoindian
Sabine River
Neches River
Calcasieu River
Mermentau River
Trinity River
San Jacinto R.
Colorado River
Brazos River
Lavaca River
Guadalupe River
San Antonio River
0 50 100 km
0 50 100 mi

F
12,500 BP
Early Paleoindian
Sabine River
Neches River
Trinity River
San Jacinto R.
Calcasieu River
Mermentau River
Colorado River
Brazos River
Lavaca River
Guadalupe River
San Antonio River
0 50 100 km
0 50 100 mi

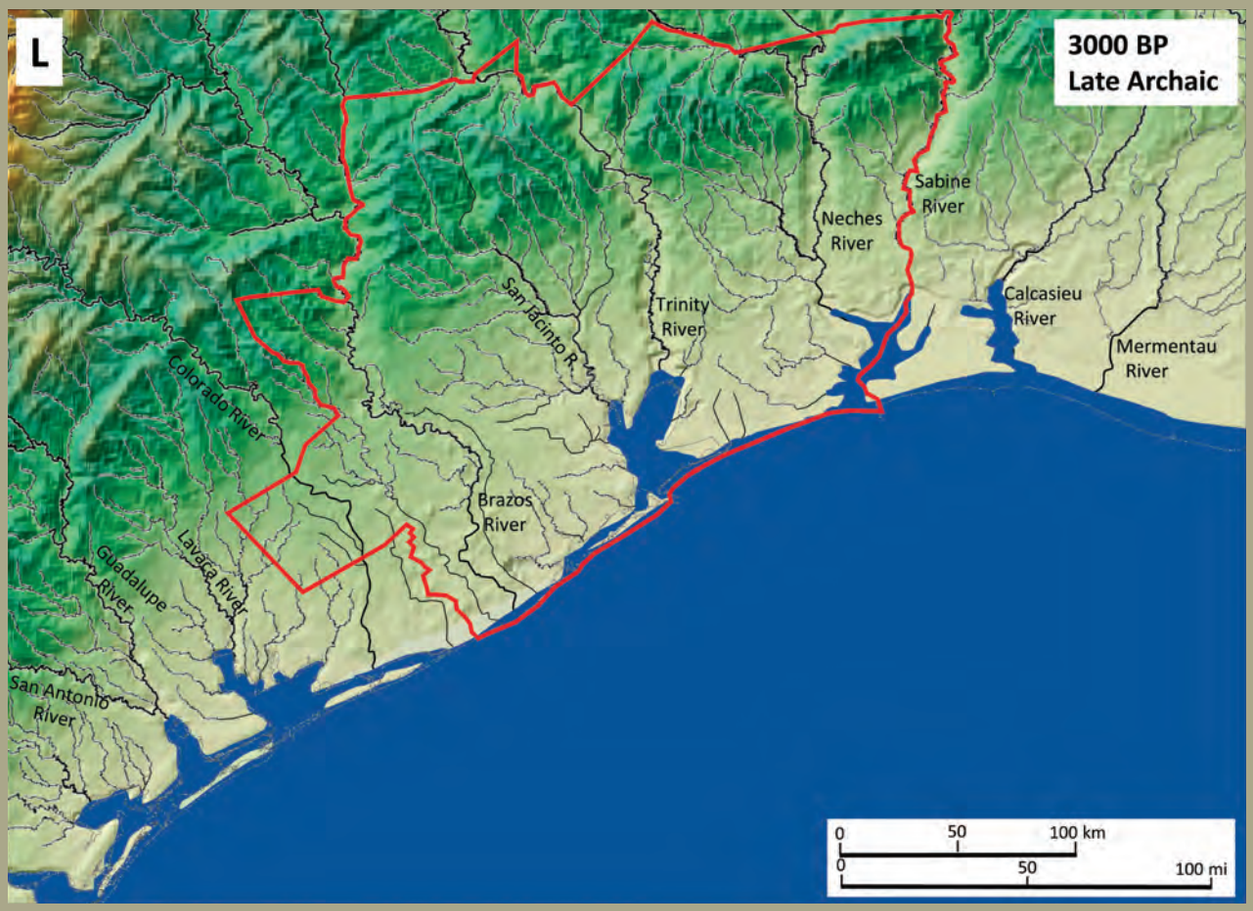
G
11,500 BP
Late Paleoindian
Sabine River
Neches River
Trinity River
San Jacinto R.
Calcasieu River
Mermentau River
Colorado River
Brazos River
Lavaca River
Guadalupe River
San Antonio River
11,500 BP
0 50 100 km
0 50 100 mi

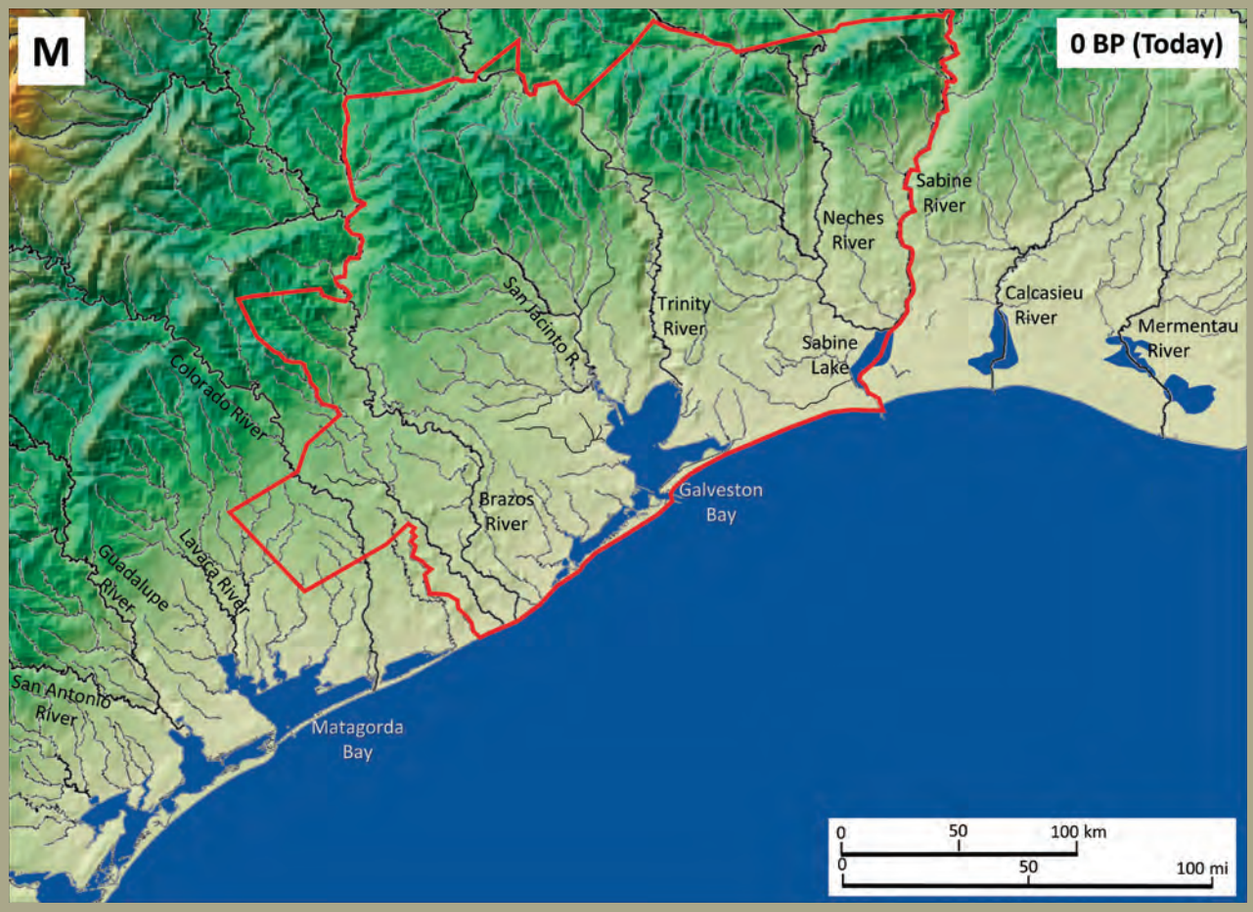
H
10,000 BP
Late Paleoindian
Sabine River
Neches River
Trinity River
San Jacinto R.
Calcasieu River
Mermentau River
Colorado River
10,000
Brazos River
9800
Future Sabine Bank
9500
Guadalupe River
Lavaca River
San Antonio River
0 50 100 km
0 50 100 mi

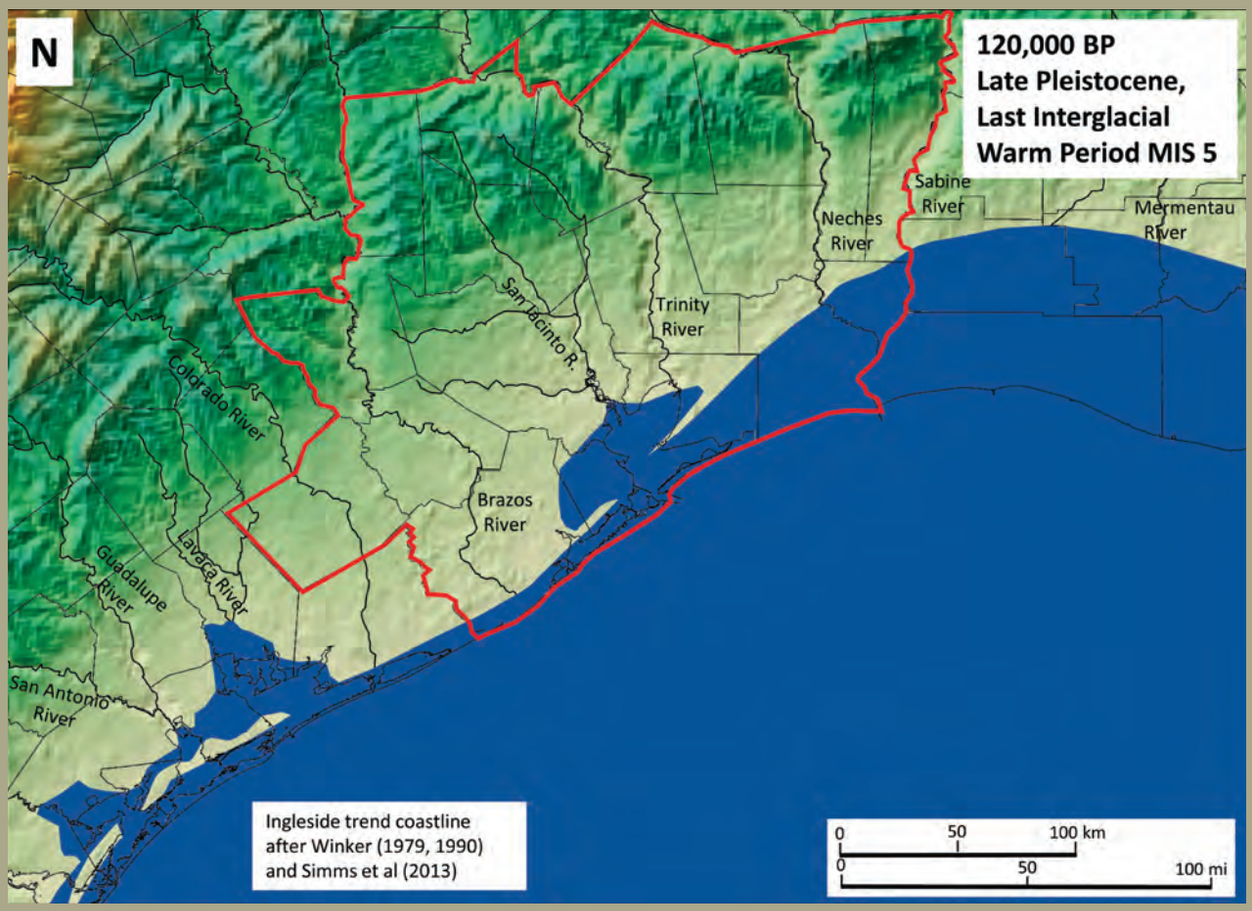
I
9,000 BP
Beginning of Early Archaic
Sabine River
Neches River
Trinity River
San Jacinto R.
Calcasieu River
Mermentau River
Colorado River
8500
Brazos River
7900
Sabine Bank
7500
Heald Bank
Guadalupe River
Lavaca River
San Antonio River
0 50 100 km
0 50 100 mi

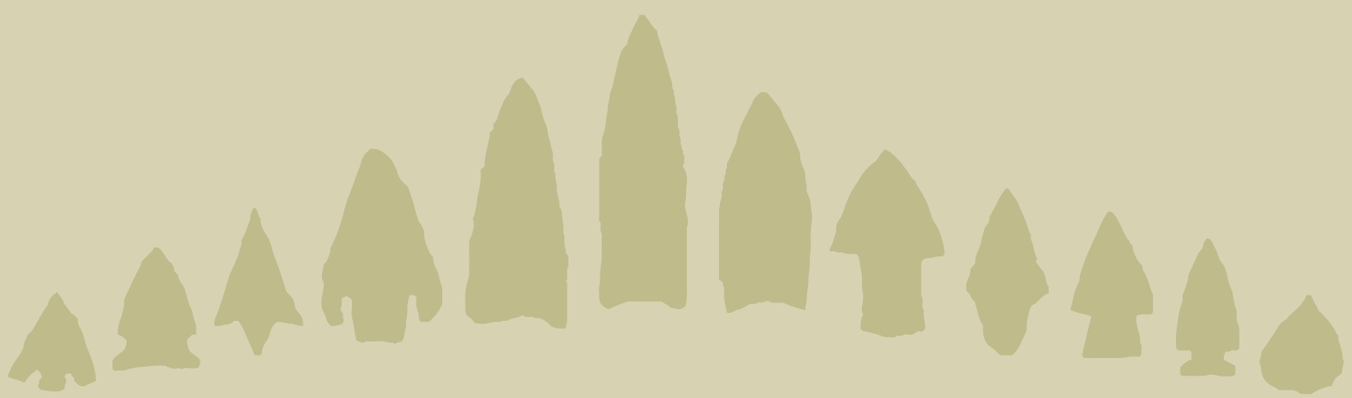
J
7,000 BP
End of Early Archaic
Sabine River
Neches River
Trinity River
San Jacinto R.
Calcasieu River
Mermentau River
Colorado River
Brazos River
Sabine Island
Lavaca River
Guadalupe River
San Antonio River
0 50 100 km
0 50 100 mi

K
5000 BP
Middle to
Late Archaic
Sabine River
Neches River
Trinity River
San Jacinto R.
Calcasieu River
Mermentau River
Colorado River
Brazos River
4700
Sabine Island
Lavaca River
Guadalupe River
San Antonio River
0 50 100 km
0 50 100 mi


L
3000 BP
Late Archaic
Sabine
River
Neches
River
Calcasieu
River
Mermentau
River
Trinity
River
San Jacinto R.
Colorado River
Brazos
River
Lavaca River
Guadalupe
River
San Antonio
River
0
50
100 km
0
50
100 mi


M
0 BP (Today)
Sabine
River
Neches
River
Calcasieu
River
Mermentau
River
Trinity
River
Sabine
Lake
San Jacinto R.
Colorado River
Galveston
Bay
Brazos
River
Lavaca River
Guadalupe
River
San Antonio
River
Matagorda
Bay
0
50
100 km
0
50
100 mi


N
120,000 BP
Late Pleistocene,
Last Interglacial
Warm Period MIS 5
Sabine River
Neches River
Mermentau River
Trinity River
San Jacinto R.
Colorado River
Brazos River
Guadalupe River
Lavaca River
San Antonio River
Ingleside trend coastline
after Winker (1979, 1990)
and Simms et al (2013)
0 50 100 km
0 50 100 mi



# 3.

# Prehistoric and early Historic Period ecosystems of Southeast Texas

## Introduction

A critical piece of information for any archeological investigation is the lay of the land, including the present and former topographical and vegetational setting. Native American activities that took place at a site in a prairie, for example, are likely to have been somewhat different than those in a dense woodland. However, the current setting of many areas is not the same as it was prior to European settlement. For example, ongoing Houston Archeological Society excavations at Kleb Woods County Park near Tomball, Texas, occur beneath the shade of a forest canopy, but historical information shows that the entire tract lay in a treeless prairie 150 years ago. Archeological sites that lie within extensively cultivated open cropland within the Brazos and Colorado River floodplains once lay within dense bottomland forests. And of course, the huge urban area of Greater Houston has dramatically altered the former vegetal landscape, often beyond recognition. A first task of this chapter is to prepare a map depicting what the vegetal landscape looked like immediately prior to significant European settlement.

From that starting point, we can address the subject of what the landscape looked like throughout the time of Native American occupancy, from the Late Pleistocene until about AD 1700. Attaining such an understanding of past coastal Texas landscapes is made difficult by several issues, beyond those of the dramatically changing Late Pleistocene and Holocene coastlines during rising sea level that

were discussed in the previous chapter. Pollen spores, a mainstay of most studies of past landscapes, are poorly preserved in humid Southeast Texas soils, although recent studies of pollen and phytoliths from Hall's Cave in Central Texas have increased understanding of vegetal development in the Edwards Plateau to the west (Cordova and Johnson 2019). And then there is the issue of how much alteration of the vegetal landscape was done during Holocene time by Native Americans themselves. This topic, especially regarding the regional use of fire in the landscape by Native American peoples, has received little attention until recent decades, when a fuller appreciation of the shaping of landscapes by human activity in North America—albeit still somewhat controversial—has emerged.

A final question confronting us is the nature of the landscape at the assumed time of entry of Native Americans into the Southeast Texas region, during the Late Pleistocene. The climate at the time of the Last Glacial Maximum (22,000 BP) was about three or four degrees cooler (Shakun et al. 2012) as well as effectively wetter than present (Cordova and Johnson 2019), which raises questions about how significantly different the Southeast Texas vegetal landscape may have been at that time, relative to the better understood Edwards Plateau. In lieu of the presence of extensive palynological databases for coastal Texas, a database of Late Pleistocene megafauna fossil sites was compiled from outcrops of the coastal Late Pleistocene Beaumont Formation and from time-correlative parts of upland Deweyville river terraces and stream alluvium. These fossils are from the time extending from the last glacial warm period ca. 120,000 BP up to 12,600 BP, when most of these large mammals became extinct. An examination of the placement of megafauna on the modern vegetal landscape gives a rough, qualitative view of the presence of grassland vs. forest in this region.

## Shaping of ecoregions by early European settlers

When Stephen F. Austin made his first trip to Texas, arriving in San Antonio in August 1821, he was permitted by the nascent Mexican government to survey the region between the San Antonio and Brazos rivers for a suitable place for his colony. Setting out with some assistants and a few Aranama Indians, he made transects across the region and travelled up and down the main rivers. Using available maps of the area—the Spanish were not known for their interior cartography—he produced a map in 1822 that showed the main forested regions (Figure 3.1). The Spanish footprint on this vast land had been miniscule, consisting of a few missions, most notably at San Antonio and at La Bahía (modern Goliad), but also including abandoned mission sites along the San Gabriel River and—in Southeast Texas—at Orcoquisac (modern Wallisville, near where the Trinity River spills into Galveston Bay; see Chapter 4). Austin's map shows us the land as the Atakapa and Karankawa knew it. The large East and Southeast Texas forest is clearly defined, along with the Caddoan villages at Nacogdoches, at the location of the modern town of that name (Location 11), and the Viais (Bidai) villages along the Trinity River (Location 9).

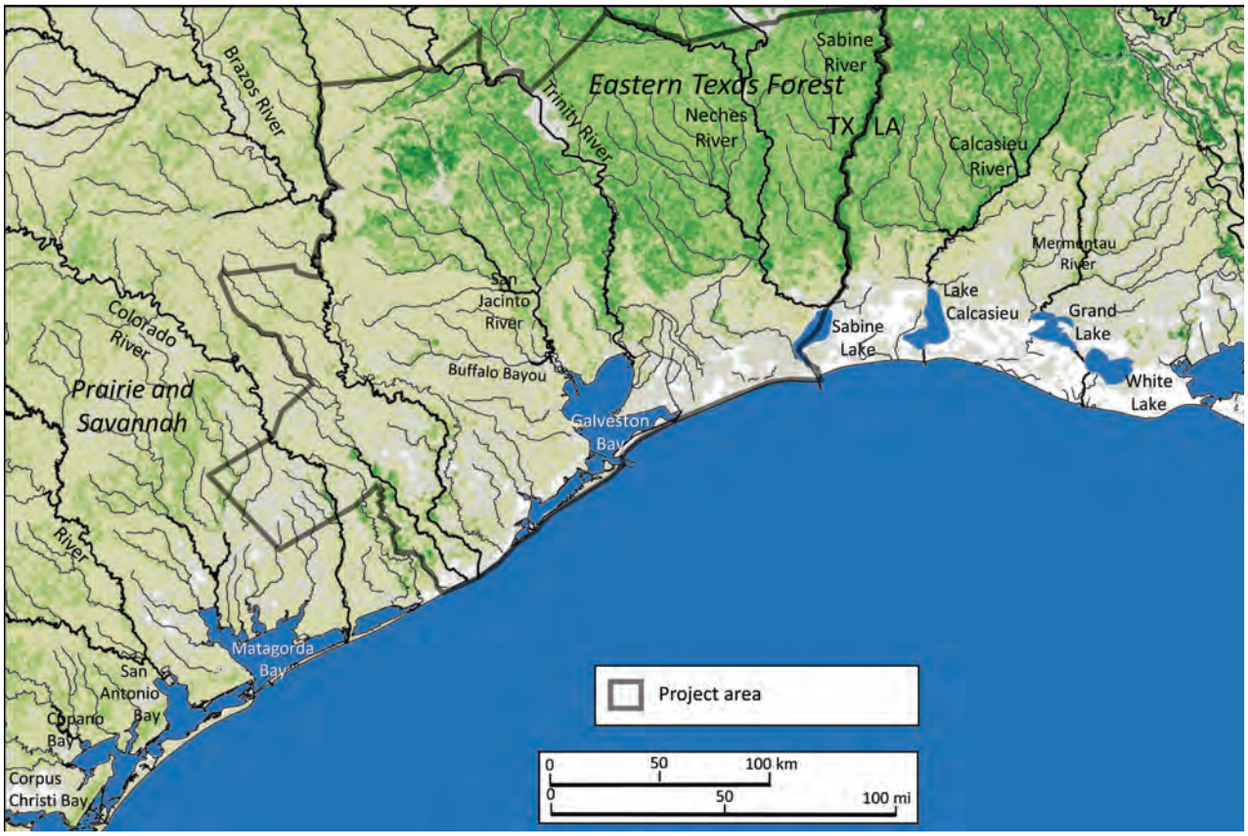
Austin's selection for his new colony included the floodplains of the Colorado and Brazos rivers (Locations 1 and 2). As the green shading on the 1822 map shows, these at the time were massive virgin forests. Why would he choose forest land? It was not the bottomland forest but the rich bottomland soil that lay beneath those

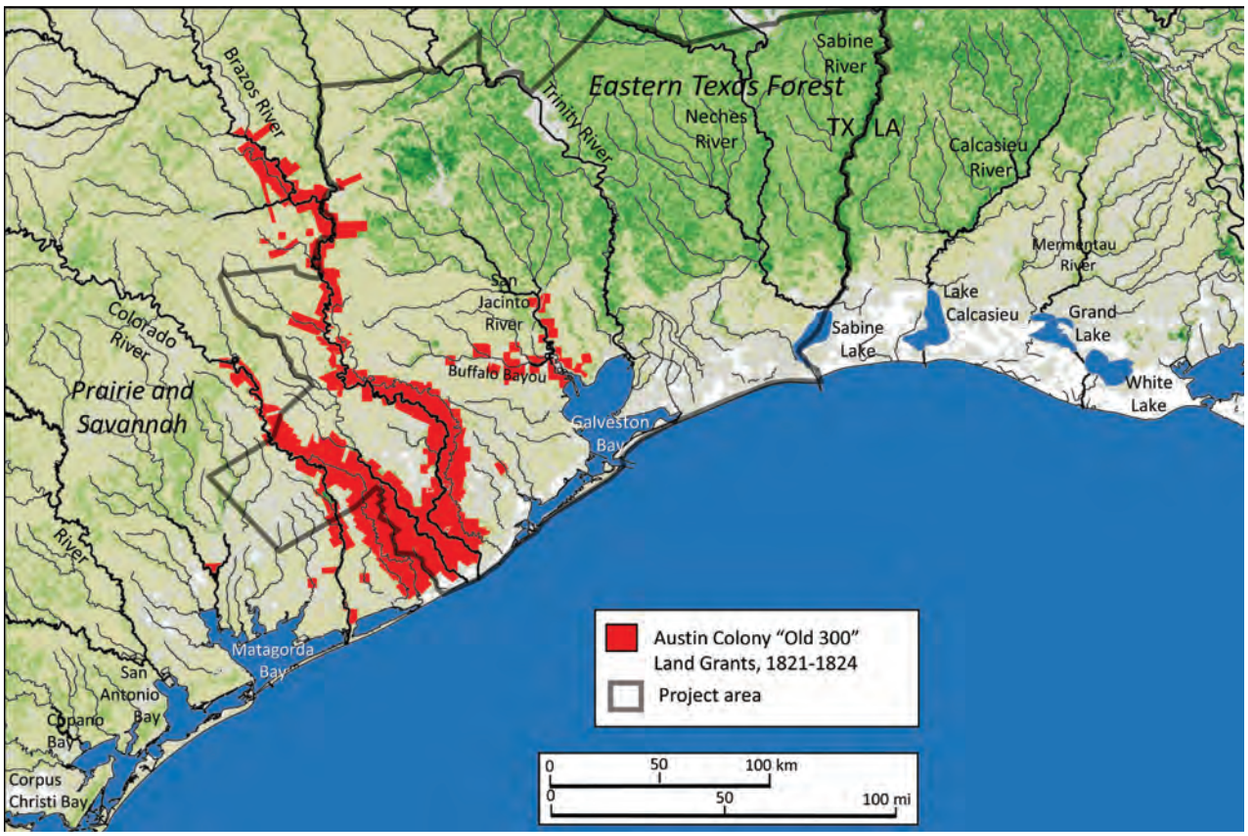
Figure 3.1. Topographic Map of the Province of Texas, by Stephen F. Austin, 1822. Map courtesy of the Library of Congress. Location numbers added for discussion in text:

1. Brazos River
2. Colorado River. The floodplain bottomland forests of the Brazos and Colorado Rivers, which became the target for cotton planters from the southern United States.
3. San Bernard prairie, a cul de sac with forested edges that was a prime bison- and deer-hunting ground.
4. Katy prairie, another key hunting area.
5. *Gran Bayou* (probably Buffalo Bayou)
6. *Bahía de Galveston* (Galveston Bay)
7. San Jacinto River
8. Trinity River
9. *Viais* (Bidai village). To the south is a *Cochata* (Coushatta) village, and to the east an Alavanes (Alabama) village; both of these Native American groups were recent arrivals from what is now the southeastern United States, where they were pushed out by European settlement.
10. *Rio Sabinas* (Sabine River)
11. Nacogdoches Caddoan village (modern town of Nacogdoches)
12. *Isla de S. Louis* ("Island of St. Louis," modern Galveston Island)
13. *Punta Orquisac* (modern Bolivar Peninsula)
14. *Caransahuases* (Karankawa) villages between San Antonio Bay and the mouth of the Nueces (Corpus Christi Bay not shown)
15. Matagorda Bay

forests that attracted the early Anglo colonists. As a map of modern forested areas shows (Figure 3.2, of total "carbon stocks" from the U.S. Forest Service; see Chapter 1 for discussion), those Colorado and Brazos bottomland forests are now all but gone, except for remnants in the coastal parts of those river valleys. The early Texas colonists came in the hundreds from old South cotton plantations with exhausted soil—depletion caused by intensive cultivation of cotton in an era before artificial fertilizer—and they brought enslaved African Americans with them to work the land. The extent to which these earliest colonists (the so-called "Old 300" settlers of 1822–1824) sharply focused their land acquisition on the Brazos and Colorado forested floodplains can be seen in Figure 3.3, which highlights in red the areas where they obtained land grants; nearly all the early settlers chose these forested bottomlands for their new plantations.

The method of large-scale conversion of forest into cropland, in an age before chain saws and bulldozers, was fairly simple and harkened back to earliest European settlement of eastern America two centuries earlier. The planter and his servants would girdle the large trees, cutting away the outer cambium beneath the bark. A


Brazos River
Trinity River
Sabine River
Eastern Texas Forest
Neches River
TX LA
Calcasieu River
Mermentau River
Lake Calcasieu
Grand Lake
Sabine Lake
White Lake
San Jacinto River
Buffalo Bayou
Galveston Bay
Colorado River
Prairie and Savannah
River
Matagorda Bay
San Antonio Bay
Copano Bay
Corpus Christi Bay
Project area
0 50 100 km
0 50 100 mi


Brazos River
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Calcasieu River
Mermentau River
Lake Calcasieu
Grand Lake
Sabine Lake
White Lake
San Jacinto River
Buffalo Bayou
Galveston Bay
Colorado River
Prairie and Savannah
River
Matagorda Bay
San Antonio Bay
Copano Bay
Corpus Christi Bay
Austin Colony "Old 300" Land Grants, 1821-1824
Project area
0 50 100 km
0 50 100 mi

Figure 3.2. Regional vegetation map highlighting areas of modern forests, from Wilson and others (2013), U.S. Forest Service. The intensity of green shading represents total forest carbon stocks, which correlate in general to intensity of present day forest cover. In general, dark green areas represent forests, paler green areas represent prairie, and mottled areas are savannahs or (in South Texas) areas of heavy brush.

watercolor painting of a Colorado River plantation during the era of slavery and cotton (Figure 3.4) shows a group of enslaved women cultivating cotton under the threatening eye of an overseer, with a backdrop of girdled, dead trees that once constituted the bottomland forest. The widespread destruction of the Brazos and Colorado bottomland forest marked the first large-scale change to the landscape made by European settlers in Texas, and most of that area remains cropland today, given to cotton, corn, and sorghum. Parts of the lower Trinity River bottomland forest were likewise cleared during colonial times, but most of that has reverted to forest over the years. A comparison of Figures 3.1, showing the pre-settlement state of the forested Colorado and Brazos river valleys, with Figure 3.3, showing the cotton plantations of the "Old 300" land grants of early colonization, with Figure 3.2, the post-settlement result, shows how extensive an alteration these early colonists made upon the landscape; it was the destruction of a forested ecosystem that, had satellites then been available, could easily have been seen from space. Not visible from space would have been the catastrophic impact of this occupation and deforestation upon the Coco people who lived in the bottomland and delta plain around the lower Colorado and Brazos rivers; their history is taken up in the following chapter.

Figure 3.3. Land grants of the "Old 300," the first land grants made in Stephen F. Austin's colony. These grants were made by 1824. Base map of total carbon stocks is as shown in Figure 3.2.

Other than the large-scale conversion of prairie and bottomland forest to cropland, the largest single change to the landscape has been caused by the twentieth- and twenty-first-century urban sprawl of cities, especially that of the largest city in the region, Houston. Its developed area stretches some sixty by eighty miles (Figure 3.5); a closer modern view of the sity's west side (e.g., Figure 3.6A) shows the developed urban area obscuring what the natural landscape looked like prior to the city's founding in 1836. Fortunately, a topographic survey of most of the Houston region was made by the U.S. Geological Survey in 1915 (Figure 3.6B), prior to much of the growth that occurred during the second half of the last century. That survey delineated the original forest-prairie boundary, which was mostly still intact in the then rural surrounding area. Already by 1915, however, Houston had a growing urban core that obscured earlier vegetation boundaries (Figure 3.6B), but a yet earlier map of 1824 of the area that later became central Houston (Figure 3.6C) allows the original vegetation boundaries of the earliest (now downtown) area to be approximated; Figure 3.6D shows the final interpretation. In like fashion, regional scale (1:250,000) topographic maps of the U.S. Geological Survey that were made in the 1950s and 1960s were used to outline forested areas on the summary compilation map of Figure 3.7, including many areas that have fallen to more recent urban sprawl.

## Ecoregions map of Southeast Texas prior to European arrival

A summary map depicting the pre-settlement ecoregions of Southeast Texas and southwestern Louisiana has been compiled from various modern and historical sources and is shown in Figure 3.7. Modern day resources included the *Vegetation Cover Types of Texas* map of the Texas Bureau of Economic Geology (2000) as well as work by Todd and Ogren (2016:10) and the Houston Wilderness project's *Houston Atlas of Biodiversity* (2007). Louisiana's modern ecoregions are excerpted from Daigle and others (2019). The ecoregions shown on the compilation map are sim-

plified into the following six basic units, using descriptions modified from Daigle and others (2019**).**

**Coastal Marshes**: Flat tidal marshes, some of which are covered with standing water overlying clay-rich soil, as well as sandy barrier islands and (in Louisiana) sandy chenier ridges. Marshes are covered variously by saltgrass, cordgrass, maidencane, and sawgrass, with live oaks with a palmetto understory on sandy ridges.

**Tallgrass Prairie, with riparian forests along streams**: Originally, a prairie of big and little bluestem, Indiangrass, switchgrass, paspalum and other prairie grasses and forbs, on a flat coastal plain with innumerable low pimple mounds, underlain by poorly drained, often clay-rich soil. Dissected by low-gradient rivers, streams, and bayous. Today most of the former prairie is cropland or ranchland.

**Post Oak Savannah**: A savannah of mottes of post oaks surrounded by prairie grasses. In some areas post oaks coalesce into dense forest, and in other areas post oaks are isolated specimens or mottes surrounded by grassland.

**Flood Plain (Bottomland) Forest**: Large river floodplains with associated terraces of Pleistocene alluvium. Originally these areas had a forest cover of water oak, pecan, cypress, live oak, and elm. Today much of the Brazos-Colorado bottomland has been cleared and placed into cropland.

**Big Thicket/Flatwoods**: Flat to gently sloping expanse of poorly drained soils and sluggish streams. The original vegetation was dominated by longleaf pine savannahs of tall pines in a low undergrowth of widely diverse herbaceous species. Today, in the absence of frequent burning and in the presence of timber forestry, these longleaf pine savannahs have been largely replaced by thick stands of loblolly and slash pines, locally interspersed with sweetgum, white oak, red oak, willow oak, blackgum, and hollies, with a thick and tall undergrowth of yaupon and other herbaceous species. This latter environment is known in Texas as the Big Thicket and in Louisiana as Flatwoods.

Figure 3.4. A destroyed forest under cotton cultivation on a plantation on the Brazos River floodplain. Enslaved African American women are working under the harsh gaze of an overseer. The landscape shows the effect of girdling trees to kill them, making room for crops. The drawing is thought to be the work of Lino Sánchez y Tapía, a scientific illustrator on fhe Mier yTerán expedition of 1827-28. Sánchez y Tapía visited the Groce plantation on the Brazos River floodplain in May, 1828. The image is from the collection of the late William J. Hill, courtesy of the Museum of Fine Arts, Houston.

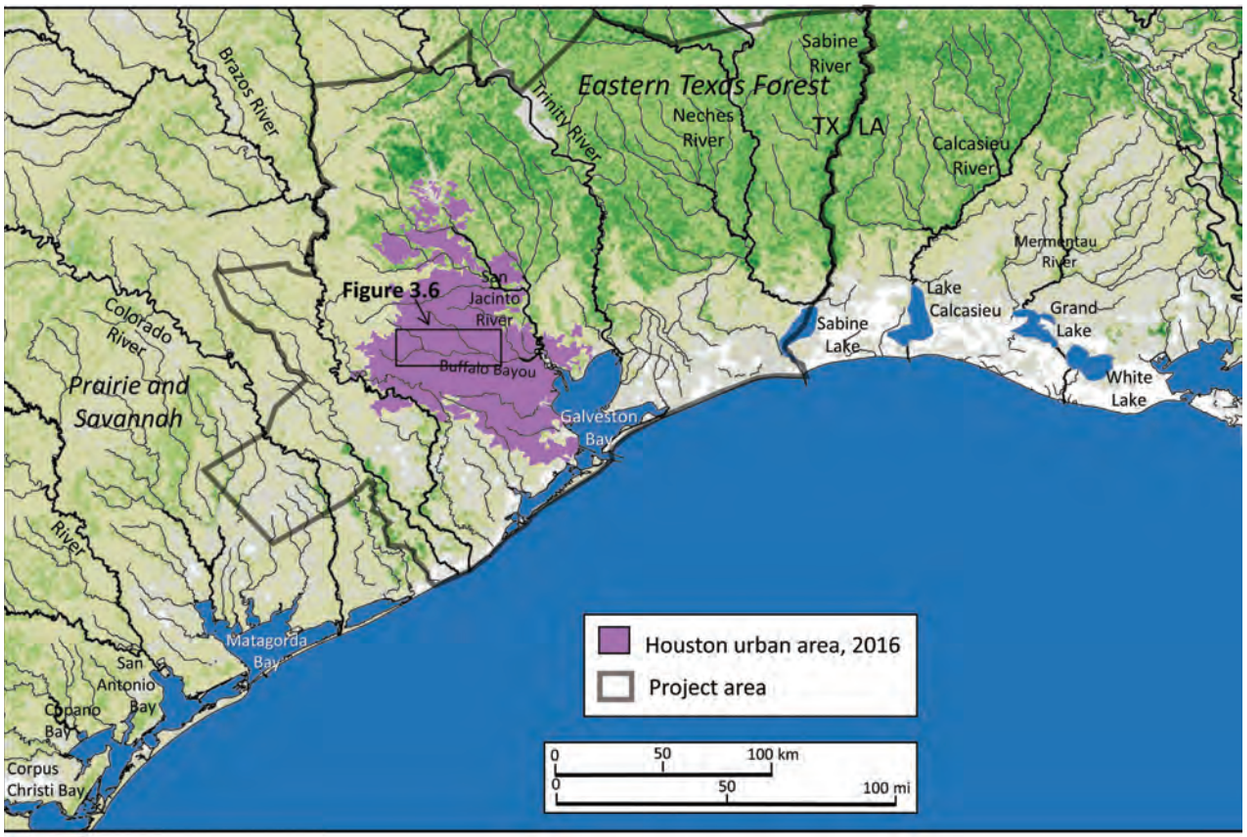
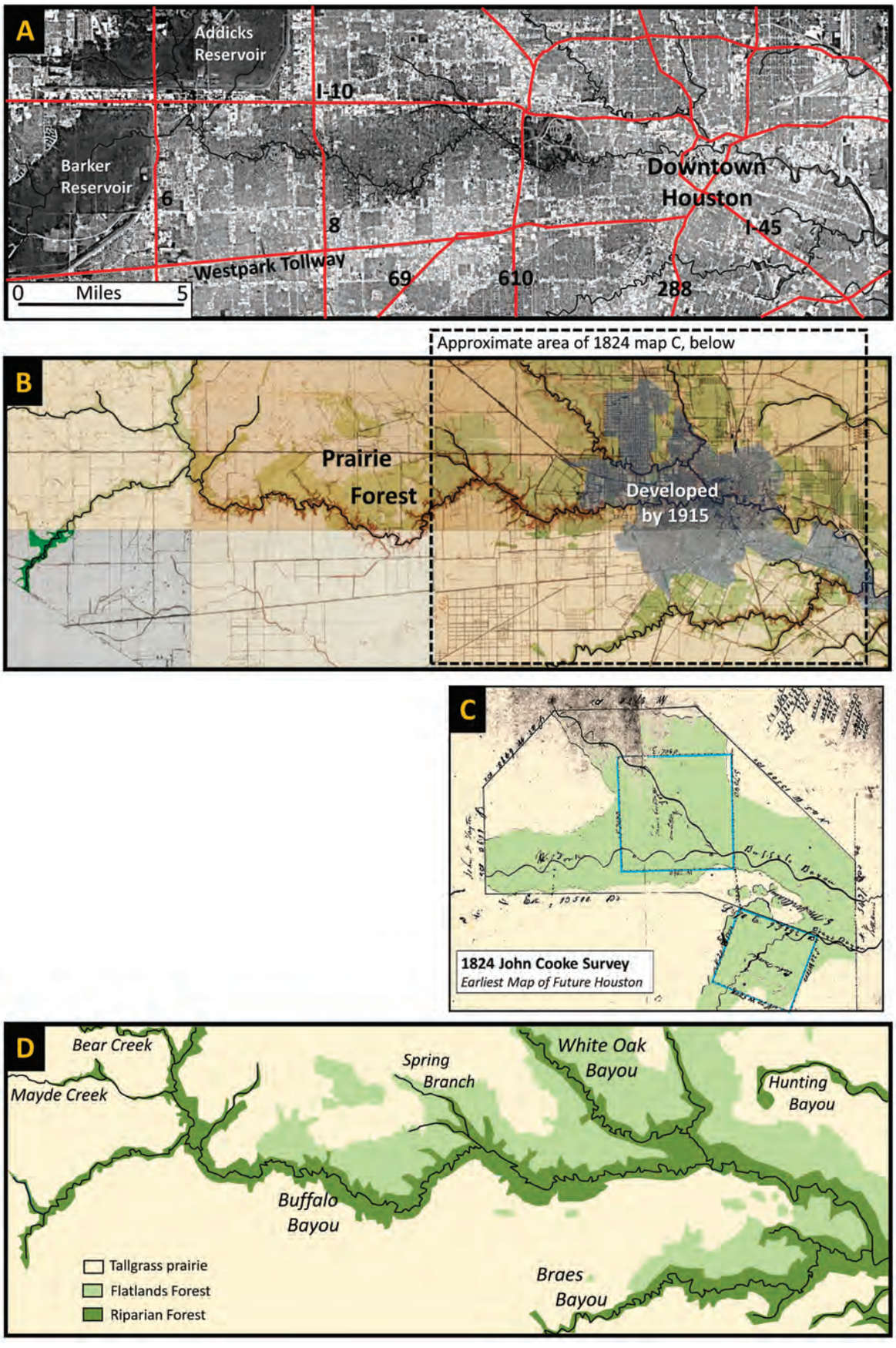



Figure 3.5. Footprint of the Greater Houston urban area as of 2016. Base map of total carbon stocks is as shown in Figure 3.2.

**Pineywoods**: The Texas Pineywoods (a.k.a. Southern Tertiary Uplands in Louisiana) is a hilly upland with sandy loam soils, historically supporting a vegetative cover of longleaf pine with shortleaf pine and mixed hardwoods, including beech and oak. There are small interspersed bluestem prairies. Today much of this is National Forest land with loblolly pine forests.

The boundary between Pineywoods and Flatwoods is defined by the effects of underlying geology upon topography and drainage. The Pliocene Willis Formation, a sandy unit with hilly expression, underlies the southernmost Pineywoods, and the early and middle Pleistocene Lissie Formation, which has a low, flat topographic expression and produces more clay-rich soils, underlies the Flatwoods. That geologic change not only tracks the Pineywoods-Flatwoods contact but also tracks, in the prairies to the southwest of the forest, the contact between the Post Oak Savannah and the Tallgrass Prairie (compare Figure 2.6, a geologic map, with Figure 3.7). The combined Pineywoods and Big Thicket forest is termed the Eastern Texas Forest in this report.


A
Addicks Reservoir
I-10
Barker Reservoir
6
8
Westpark Tollway
69
610
288
Downtown Houston
I-45
0 Miles 5
Approximate area of 1824 map C, below
B
Prairie
Forest
Developed by 1915
C
1824 John Cooke Survey
Earliest Map of Future Houston
D
Bear Creek
Mayde Creek
Spring Branch
White Oak Bayou
Hunting Bayou
Buffalo Bayou
Braes Bayou
Tallgrass prairie
Flatlands Forest
Riparian Forest

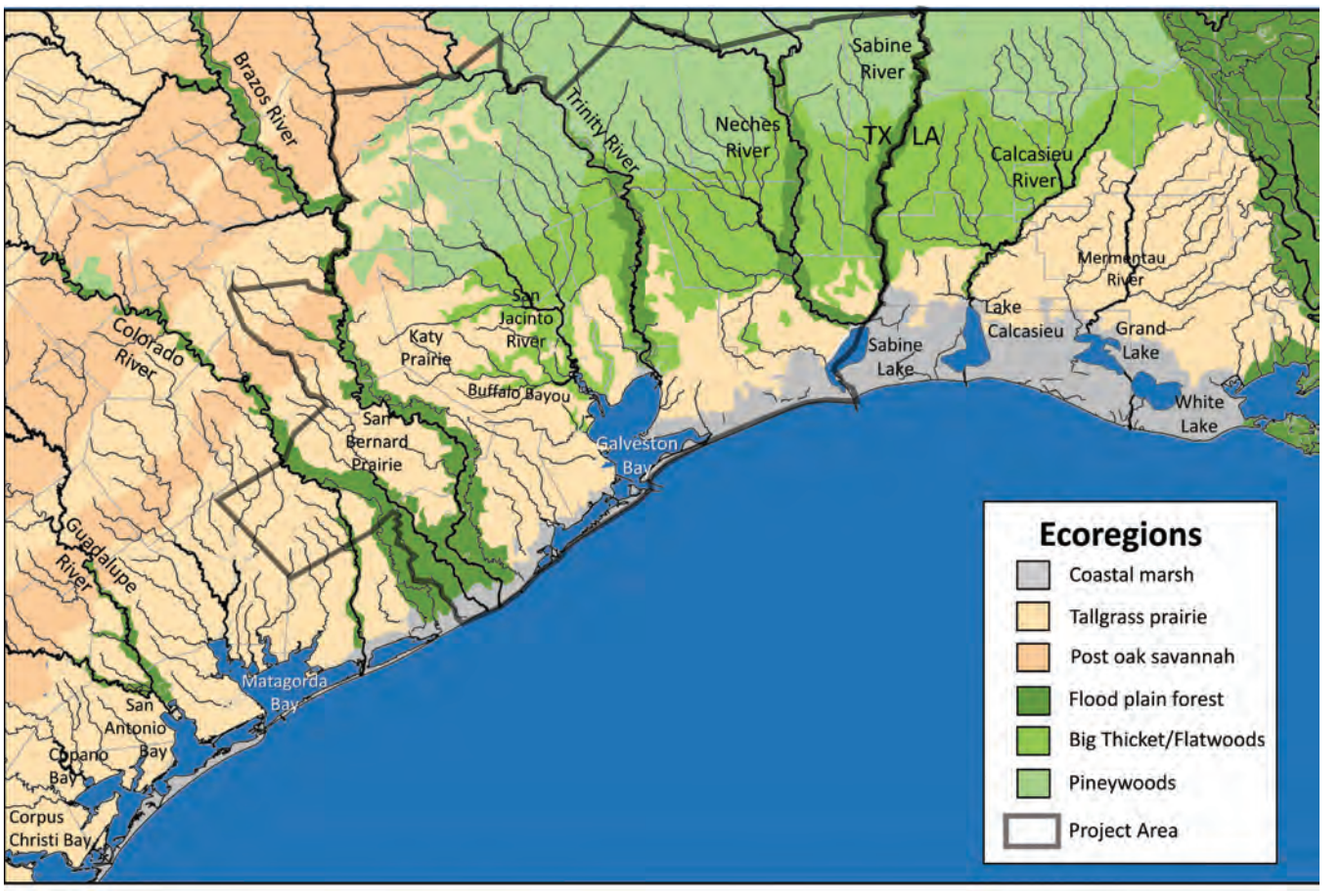



Figure 3.7 (above). Interpreted ecoregions of Southeast Texas and southwestern Louisiana ca. 1800, prior to substantial European settlement.
Figure 3.6 (left). A–D. Source materials for reconstructing the bound-aries of original ecosystems of the west Houston urban area.

A. Aerial photo, ca. 2016, with main highways highlighted in red.
B. Early U.S. Geological Survey maps, mostly ca. 1915, showing patterns of rural vegetation. Cour-tesy of the Perry-Castañeda Map Collection, University of Texas at Austin.
C. Inset area (see Map B for location) of future downtown Houston, as mapped in 1824. Green areas represent 1824 forests. Image from Worrall (2016), courtesy of the General Land Office.
D. Reconstructed pattern of original vegetation, from Worrall (2016).

## Shaping of ecoregions by Native Americans

When the first Anglo and African American settlers entered coastal areas of southeast Texas under Mexican colonial grants, they entered a coastal area in which most of the region's original Native Americans (the Akokisa, Bidai, and Atakapan proper) were all but absent, having almost entirely perished as a result of European diseases transferred to them during the previous century by Spanish and French explorers and traders (see Chapter 4). Early Texian visitors described an endless prairie that appeared as if it were a wilderness garden of Eden, where wild game was amazingly abundant. Such an interpretation of a "primeval wilderness" was likewise delivered by early generations of American poets and philosophers (for example, Henry David Thoreau) for parts of eastern North America where Native Americans had similarly been greatly reduced in numbers by disease. This point of view persists to this day among some history writers, such as Shetler (1991), writing about the legacy of Columbus:

> *Pre-Columbian America was . . . the First Eden, a pristine natural kingdom. The native people were transparent in the landscape, living as natural elements of the ecosphere. Their world, the New World of Columbus, was a world of barely perceptible human disturbance. (Shetler 1991:226)*

However, as ethnologists, scientists, and agriculturalists have combed over old ac-

counts of the American landscape, a new description has gradually emerged during the last half century: a description of a land that had been extensively shaped by Native Americans. As journalist and historian Charles Mann has written:

> *Europeans tended to manage land by breaking it into fragments for farmers and herders. Indians often worked on such a grand scale that the scope of their ambition can be hard to grasp. They created small plots, as Europeans did (about 1.5 million acres of terraces still exist in the Peruvian Andes), but they also reshaped entire landscapes to suit their purposes. A principal tool was fire, used to keep down underbrush and create the open, grassy conditions favorable for game. Rather than domesticating animals for meat, Indians retooled whole ecosystems to grow bumper crops of elk, deer, and bison. The first white settlers in Ohio found forests as open as English parks—they could drive carriages through the woods. Along the Hudson River the annual fall burning lit up the banks for miles on end; so flashy was the show that the Dutch in New Amsterdam boated upriver to goggle at the blaze like children at fireworks. In North America, Indian torches had their biggest impact on the Midwestern prairie, much or most of which was created and maintained by fire. Millennia of exuberant burning shaped the plains into vast buffalo farms. When Indian societies disintegrated, forest invaded savannah in Wisconsin, Illinois, Kansas, Nebraska, and the Texas Hill Country. (Mann 2002, 2005)*

Historical views like this are breathtaking but have been built upon technical observations that have been gathering for a generation (e.g., Denevan 1992). For the purposes of the present study, I examine Native American alteration of two environments, forest and prairie, first in a general historical context and then in the context of observation on the ground in Southeast Texas.

## Forest management

Early European visitors and settlers noted Indian practices of clearing forests with fire (Hammett 1992; Stewart 2002). In the forests of Virginia in 1609, H. Spelman

Figure 3.8. Two photographs of virgin longleaf pine savannah in the east Texas Pineywoods, ca. 1910. Where savannahs were (apparently) maintained by fire in the pre-settlement era, one could drive a carriage through them with no great difficulty, in contrast to the dense thicket understory of modern forests where fire has been suppressed. Courtesy of the Texas A&M University Forest Service.

wrote that:

> *Ther maner of ther Huntinge is this [where] they meet sum 2 or 300 togither and having their bowes and arrows and every one with a fier sticke in ther hand they neset a great thikett round about, which dunn every one sett fier on the ranke grass gandg which the Deare seinge fleeth from ye fier, and the men cumminge in by a littell and little incloseth ther game in a narrow roome, so as with ther Bowes and arrows they kill them at ther pleasure taking ther skins which is the greatest thinge they desire, and sume flesh for their provision (Arber 1910, quoting Spelman, as cited by Stewart 2002).*

In New England in 1655, the Dutchman Adrian Van der Donck noted:

> *The Indians have a yearly custom of burning the woods, plains and meadows in the fall of the year, when the leaves had fallen and when the grass and vegetable substance are dry. . . . This is done . . . to render hunting easier (for stalking), to thin out woods of all dead substances and grass, which grow better in the ensuing Spring, . . . to circumscribe and enclose game . . . and because game is more easily tracked over burned parts of the woods. (Van der Donck 1846)*

Similar observations were made for southeastern forests. In 1709 it was noted in the Carolinas that:

> *When these Savages go a-hunting, they commonly go in great Numbers, and oftentimes a great many Days Journey from home, beginning at the coming in of the Winter, that is when the Leaves are fallen from the Trees, and are become dry. 'Tis then they burn the Woods, by setting Fire to the Leaves. (Lefler 1967:215)*

In the pine forests of southeastern Texas and southwestern Louisiana (Piney-woods and Flatwoods/Big Thicket), early settlers marveled at the open nature of many forested areas, which were in effect savannahs: large expanses of longleaf pine open woodland where trees where widely spaced, and where low-lying grasses and

Figure 3.9. A restored longleaf pine savannah at the Big Thicket National Preserve. Photo courtesy of Chris Adams and the National Park Service.

shrubs were dominant in between the trees. Figure 3.8 shows just such a longleaf pine forest in East Texas, about 1910. Such savannahs were once quite common, but with forest fire suppression as policy in National Forests during much of the 20th century, thick underbrush has become the rule. Moreover, timber interests have replaced much of the original longleaf pine with faster-growing loblolly and slash pine (Billings 2014:16–17).

The importance of fire in preserving such longleaf pine savannah landscapes has been understood by foresters only in the last few decades. In the Big Thicket near Silsbee, Texas, is the 5,654-acre Roy E. Larsen Sandyland Sanctuary, managed by the Nature Conservancy as a rehabilitated longleaf pine savannah (Figure 3.9) with an associated hardwood floodplain forest, part of the 3% of longleaf pine savannah remaining in the southeastern United States (Nature Conservancy 2019). These longleaf pine forests once covered some 5,000 square miles of East and Southeast Texas (Billings 2014:16–17), including almost all the areas shown as Pineywoods, and much of the area shown as Flatwoods, on the map in Figure 3.7. In the Nature Conservancy's efforts to rehabilitate the forest/savannah with prescribed fires, it was originally assumed that a burning frequency of 3–5 years would be sufficient. However, they found that more frequent burning on a cycle of at least every 18–24 months was required to keep down the undergrowth sufficiently for longleaf pine seedlings to flourish and to protect the rare herbaceous plants of the area. Such frequent burning is not supportable by the frequency of natural, lightning-started fires in the area, which are quite rare, and it is assumed that the forest was managed by frequent Native American burning in the pre-European era (Benedict 2019).

Besides hunting, Native Americans used fire to keep forest paths open for travel. Spanish explorers utilized a number of existing Native American trails in their travels in this region (Austin mapped several of them, shown as dotted lines in Figure 3.1). East Texas Indians, especially the Caddo (Tejas), were frequent participants in annual trade fairs that also required travel on trails (a map of known Indian trails of eastern Texas is displayed in Atlas V, Frame 9, discussed in Chapter 11). Both Spanish Explorer Governor Domingo Terán in 1690 and the French explorer René-Robert Cavelier, Sieur de La Salle encountered annual trade fairs where East Texas Caddos met with Indian groups from West Texas, Central Texas, and the Rio Grande (Foster 1995). Trade routes connected these groups, and these trails may have been cleared, at least periodically.

Although it is not now possible to map the extent of early longleaf pine savannah, it is well known that young longleaf pine is well attuned to periodic fire. It may be that fire-burned savannah made up the dominant part of the East Texas forests, or it may be that Native Americans regularly burned only the parts that they needed for food, travel, or other reasons. The classic term "Big Thicket" refers to areas of thick undergrowth that must have escaped frequent burning but existed alongside longleaf savannahs such as that at the Larsen preserve.

### Prairie hunting with fire

Ethnohistorical accounts indicate the frequent use of fire during communal hunting by Native Americans in the open prairie of coastal and interior south and south-

Figure 3.10. A prairie fire. From A. A. Parker, *A Trip to the West and Texas, Comprising a Journey of Eight Thousand Miles.*

eastern Texas in early historical time, and archeological data suggest that communal hunting, with or without fire, occurred in this area as far back as Early Paleoindian time, 13,000 or more years ago (Chapter 8). The historical accounts that place the use of fire in communal hunting in Southeast Texas prairies are presented in Chapter 4; some of these data are very briefly summarized here.

Cabeza de Vaca, in 1529, was the first to see the use of fire in the Texas coastal region, when he observed a group of Iguaces Indians—who lived primarily in Refugio County—kill deer by encircling them with fire. De Vaca also reported that the Iguaces drove deer in desired directions by depriving them of pasture, also by use of fire. Frenchman Henri Joutel, an officer of La Salle, watched Native Americans similarly use prairie fire at numerous times during his visit of 1684–1687. For example, Joutel described coastal Karankawans igniting a prairie fire to drive game, and later saw fire employed in the interior prairie near La Grange, but in the latter case fire was used to burn the prairie to attract bison, which were drawn in by tender vegetation that sprouted after the fire.

Later visitors to the southern Great Plains and Texas noted the frequent use of prairie fire, both by Indians and later by settlers. A. A. Parker, who visited the region in 1835, commented on the prairies in the eastern part of Texas (he travelled from Nacogdoches to the Brazos and Colorado rivers, and then to the Waco area):

> *The prairies are all burnt over twice a year—in midsummer, and about the first of winter. Immediately after the burning, the grass springs up again; so that there is an abundant supply all the year round. No country in the world can be compared to this, in the ease and facility of raising stock. (Parker 1835)*

Such a scene of prairie fire is depicted in Figure 3.10, from Parker. The artist George Catlin, who visited the prairies of the Great Plains in 1832, echoed Parker's comment on the extent and frequency of prairie burning:

> *The prairies burning form some of the most beautiful scenes that are to be witnessed in this country, and also some of the most sublime. Every acre of these vast*

Figure 3.11. A buffalo hunt in central Texas, 1830s, from a painting by A. Fisher included in David Woodman Jr.'s *Guide to Texas Emigrants*, 1835. Note the prairie fire in the background.

> *prairies (being covered for hundreds and hundreds of miles, with a crop of grass, which dies and dries in the fall) burns over during the fall or early in the spring, leaving the ground of a black and doleful colour. There are many modes by which the fire is communicated to them, both by white men and by Indians. (Catlin 1844)*

David Woodman, traveling through Texas in the early 1830s, observed Comanches hunting buffalo on horseback on the prairie, and an engraving in his book shows the use of prairie fire in driving the hunt (Figure 3.11, from Woodman 1835). Parker considered the origins of the prairies that he saw both in southern Illinois and in Texas:

> *The original cause of these extensive prairies in all the western and southern country is altogether a matter of conjecture. There is no natural impediment in the soil to the growth of forest trees over the whole extent of the country. It is certain that the fire is the cause of continuing them in existence; for where the fire is kept out, trees spring up in them, in a few years, and their growth is vigorous and rapid. . . . The fire, in very dry weather, and accompanied by a high wind, after scouring over the prairies, takes to the woodland and destroys the timber. Last fall, I saw hundreds of acres of woodland, so severely burnt over, that I had no doubt the trees were generally killed. But in some places, the forest gradually gains upon the prairie; and could the fire be kept within proper bounds, the western country would soon have an abundant supply of timber. But this cannot well be done. The Indian sets the prairie afire, for the conveniency of hunting—the emigrant sets it afire, so that the fresh grass may spring up for his cattle; and so between them both, they all get burnt over. (Parker 1835)*

Parker's attribution of fires to manmade causes is echoed slightly later by an

early German visitor to Texas in 1846, Ferdinand Roemer, who observed a prairie fire near modern Waco:

> *We were entertained before going to sleep by the beautiful spectacle of a prairie fire. Like a sparkling diamond necklace, the strip of flame a mile long raced along over hill and dale, now moving slowly, now faster, now flickering brightly, now growing dim. We could the more enjoy this spectacle undisturbed, since the direction of the wind kept it from approaching us. My companion [John Torrey, from Houston] was of the opinion that the Indians had without doubt started the fire, since they do this often to drive the game in a certain direction, and also to expedite the growth of the grass by burning off the dry grass. (Roemer 1849).*

**Prairie game drives in coastal Southeast Texas.** The Katy and San Bernard prairies form a border between the large expanse of interior prairies and savannahs and the lush zone of coastal prairies and forested bayous that surround Galveston Bay and the upper coast (Figure 3.7). These two prairies contain an abundance of archeological sites that line small wooded streams and bayous. These sites are found where streams fork, forming funnel-shaped catchments that open to the northwest, suggesting that game drives had occurred here, forcing bison and deer (the bones of which are found at the sites) into stream beds, where they were killed. The archeological data supporting hunting in these areas are discussed in detail in Chapter 8.

Many of these archeological sites show evidence of occupation of some 13,500 years, from the Early Paleoindian through the Late Prehistoric periods. Some are obvious bison kill sites, with bones showing butcher marks and containing imbedded projectile points. Bifacial knives, used by Native Americans for skinning game, and scrapers used for preparing hides, are common at these sites. There is evidence in many of these sites of the cooking of meat via small mounds of fired clay balls that were used as heat sources; these clay balls are emblematic of the prairie funnel sites but are not particularly common elsewhere in the region. Ethnohistoric data from both Spanish and French visitors place communal Native American hunting groups in this hunting area in the eighteenth century, typically as short-term visitors in the fall and winter months (Chapter 4).

Limited archeological data suggest that fire was in use with hunting activities, as has been observed in ethnohistoric accounts already mentioned. Site 41WH19

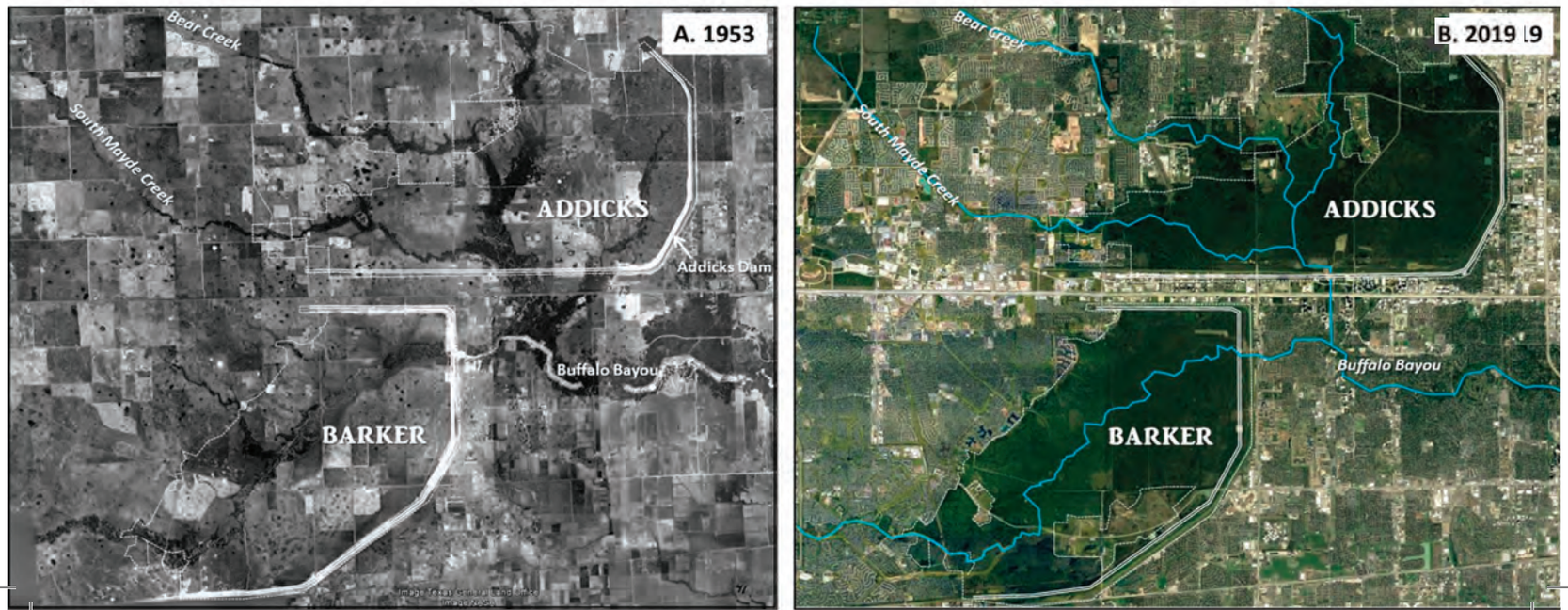



Figure 3.12. Aerial photos of the Barker and Addicks reservoirs

A. Photo from 1953, a few years after construction of the dams. Note the ranchland/prairie landscape transected by the wooded tributaries of Buffalo Bayou. Photo courtesy of the General Land Office.

B. In 2019 the former ranchland/prairie within the dry reservoirs is now almost fully occupied by dense forest (dark green), due to lack of fire, grazing or mowing in the intervening 60+ years. The surrounding area has been densely developed. Photo courtesy of Google Earth.

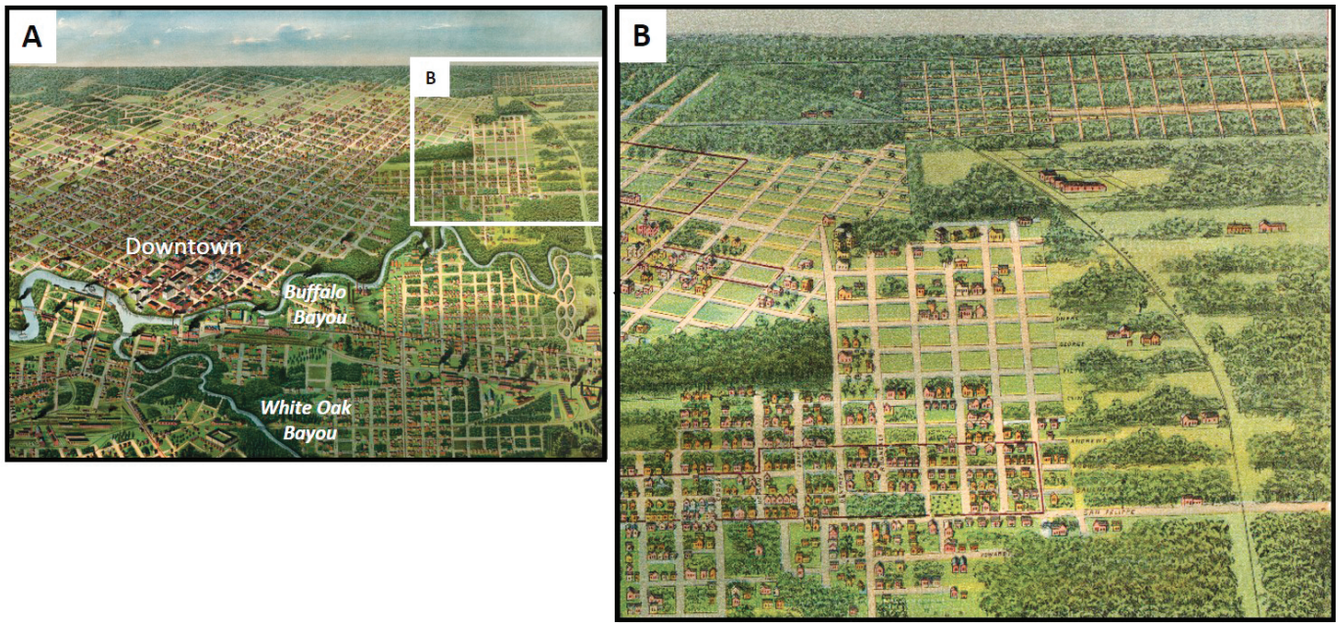



Figure 3.13. A. A bird's-eye view of the city of Houston, looking south, 1891. B. Enlargement of the area of the Fourth Ward (the curving railroad track is now Montrose Boulevard). In the first half of the 19th century the area depicted in this scene (B) was open prairie, and it was grazed as open range into the 1870s. The introduction of barbed wire in Texas in 1875 allowed landowners to fence rural parcels easily, and in the absence of burning, grazing, or mow-ing, those parcels rapidly reverted to forest. Only with the introduction of tractors in the early 20th century could such parcels be kept free of woody growth mechanically in lieu of burning. Image courtesy of the Perry-Castañeda Map Collection, University of Texas at Austin.

in the San Bernard Prairie is a well-stratified archeological site that contains multiple occurrences of charcoal, but published excavation descriptions do not allow the charcoal to be confidently distinguished as either an open area fire or a hearth. Nonetheless, charcoal fragments dated there range from 9,920 rcyBP (approximately 11,700 BP) to AD 1585. Multiple occurrences of bison remains at 41WH19 have been dated using lithic chronology to the Late Paleoindian, Archaic, Early Ceramic, and Late Prehistoric periods (Patterson 1992a).

A striking characteristic of these inland Katy and San Bernard prairie sites is that they demonstrate a continued long occupation that seems to have varied little over time (Patterson 1996), and that at the latest period of their occupation, at the beginning of Historic Period, the observed and recorded activity that occurred there was communal hunting of bison and deer.

As Parker observed, Texas and Great Plains prairies were very frequently burned, and it occurred to him that the use of fire protected the prairies from reforestation. Such would seem to be the case in these Southeast Texas prairies. For example, the Barker and Addicks dry reservoirs in west Houston, within the historic Katy Prairie area, were kept as grazing land for ranches until the 1940s and were still grassland well into the 1970s. By now they have almost entirely reverted to forest. The Army Corps of Engineers, who maintain the area as a catchment for periodic floodwater, has not mowed or burned most of the land in those reservoirs since acquisition, and the transition back to forest land is nearly complete (Figure 3.12). Some of the above-mentioned funnel-shaped stream confluences are visible in Figure 3.12A; these photographs show what happens to a 13,500-year-old prairie hunting zone in Southeast Texas when burning stops. As soon as the prairies ceased to be burned annually or mechanically cleared, the prairies reverted to forest in the span of a few generations.

That same sort of woodland regression was observed early in Houston's history.

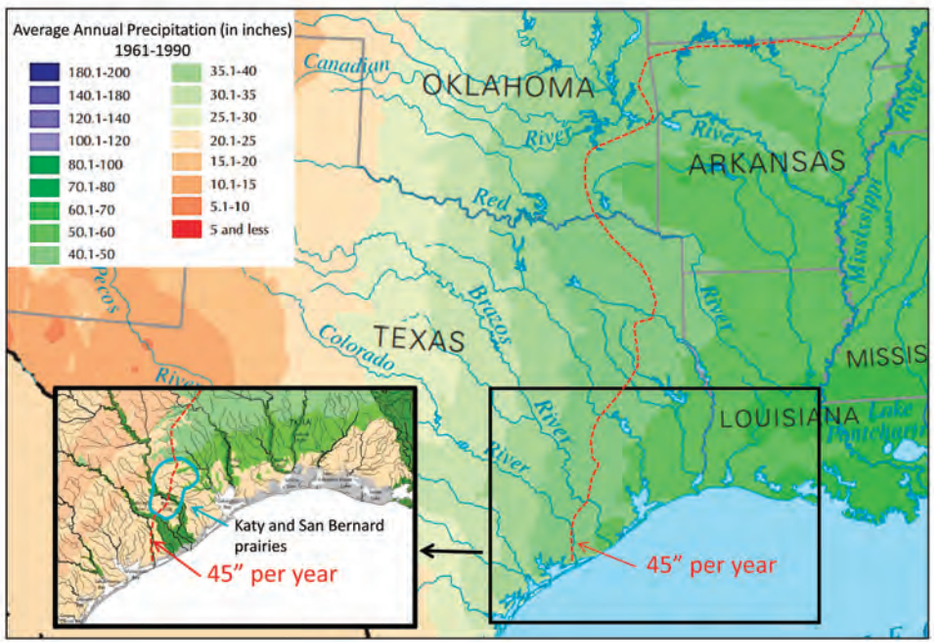



Figure 3.14. A. Average annual precipitation, Texas and Louisiana, 1961–1990, from the U.S. National Atlas. A contour representing annual precipitation of 45 inches per year is highlighted with a dashed line. An inset map shows a version of the Ecoregions map of Figure 3.7, for comparison.

Figure 3.13A shows a bird's-eye view of the city that was drawn in 1891, looking south. At the time of the city's founding, the only wooded areas in the vicinity of the central city were riparian forests along Buffalo Bayou and its tributary, White Oak Bayou; everything else in this view (except for Braes Bayou, barely visible on the far horizon at the left) was originally prairie (also see Figure 3.6D). An inset map (3.13B) enlarges a portion of the area around the inner Fourth Ward and surrounding what would later become Montrose Boulevard, which at the time of the drawing was occupied by the curving train tracks in the image. Much of this area was forested in 1891, even though many accounts demonstrate that this was all prairie and open range for livestock as late as 1870 (Worrall 2016:290 and his Chapter 11). Barbed wire was first demonstrated in Texas at San Antonio in 1875 and soon spread across the state. Fenced enclosures rapidly shut out the open range, and in places near growing cities like Houston, large scale burning by Native American groups no longer occurred. Those areas with fenced enclosures, such as those of then suburban Houston in the image, were rapidly reforested; there were then no tractors with brush shredders, and no herbicides. Moreover, this reforestation occurred before the plague of Chinese tallow and other imported trees that have infested area prairies in the twentieth century. Clearly, a prairie in the humid Southeast Texas region is fragile and needs burning or occasional mowing to survive.

A map of annual precipitation (Figure 3.14) shows a pattern of increased rainfall in the eastern part of Texas. The upland forested regions of Southeast Texas (Pineywoods and Flatwoods/Big Thicket) occupy areas where rainfall is greater than about 45 inches per year. To the west of the 45-inch rainfall contour, the same exposed geologic units are covered with open prairie and oak savannah. Along the coast, heavy clay "gumbo" soils appear to favor grasses over forests, regardless of rainfall.

From this pattern one could conclude that as humidity increases eastward across the region, only prairies with occasional burning will survive, just as Parker

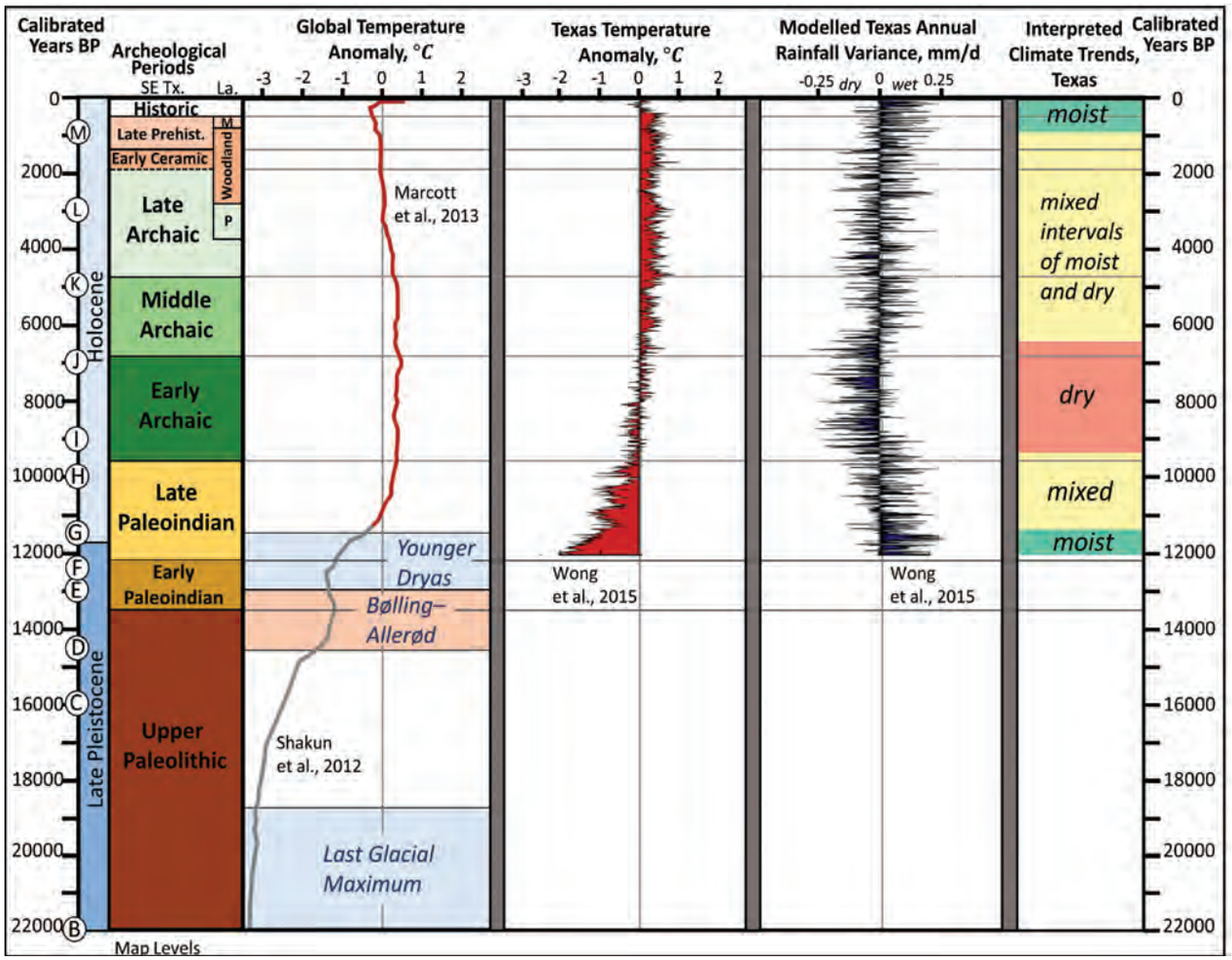



Figure 3.15. Generalized climate model for Texas. Global temperature anomaly curve shows global models of temperature variance from the present day in degrees Centigrade (from Marcott et al. 2013, Shakun et al. 2012). Next are a similar model for Texas as well as modelled Texas annu-al rainfall variance as compared to to-day (from Wong et al. 2015. shown by permission of Elsevier). A generalized interpretation of climate trends from that data, at right, is by the author. Circled letters at left represent levels of maps shown in Atlases I and IV.

postulated in 1835. In a natural setting, this burning would include burning by natural lightning fires. In the Katy and San Bernard prairies (which lie within the blue circled area on the inset map of ecoregions in Figure 3.14), it would appear likely from ethnohistoric accounts that these lightning fires were augmented by regular prescribed burning by Native American people. In effect, they appear to have managed prairies there from latest Pleistocene time. While the Atakapans and Karankawan Coco who seasonally lived at these sites in the early Historic Period may have been "hunter-gatherers" by any standard definition, in fact they were large-scale ranchers of a different sort, the significance of which was often missed by early European observers. As noted by historian William Cronon (1983:51–52), "People accustomed to keeping domesticated animals lacked the conceptual tools to recognize that the Indians were practicing a more distant kind of husbandry than their own."

## Holocene Climate in Texas

It seems clear that the Katy and San Bernard prairies *existed* as prairies throughout the Holocene, because bison were being hunted there, at least periodically, over this long period of time. Paleoclimate data that have emerged from recent research

by paleoclimatologists show that temperatures during the Holocene Epoch were remarkably stable throughout that long period. A global temperature curve of the Late Pleistocene and Holocene (Figure 3.15, left column) was compiled from the work of Shakun and others (2012) and Marcott and others (2013). They produced this combined curve by collecting 153 climate "proxy" paleotemperature datasets from around the world and digitally stacking it together. "Proxies" are measurements of natural systems that track temperature through time. Examples are temperature-sensitive planktonic foraminifera from ocean sediments, fossil pollen and other microfossil (phytolith) data, stable isotopes from ice cores in Greenland and the Arctic, and so forth. These sources are dated with radiocarbon and other methods to yield dated temperature records, which, when stacked, provide an approximate global temperature curve, as shown in the figure.

That curve shows that global temperatures at the Last Glacial Maximum were between three and four degrees cooler than now, and that temperatures rose slowly with time until the so-called Bølling–Allerød event at the end of the Upper Paleolithic, when the pace of warming abruptly increased. That warming was short-lived, and was followed by the above-mentioned Younger Dryas event, when cool temperatures revisited the globe at the end of the Late Pleistocene (Figure 3.15). Following that event, temperatures warmed to a level that was remarkably stable from the early Holocene to the present day, notwithstanding the sharp spike in temperature in the past century. The warmest period was observed in the Early and Middle Archaic, when temperatures were like those of the present century.

Wong and others (2015) undertook a similar exercise, but for proxy data only from the Texas and southern Oklahoma area (Figure 3.15, center column). Their temperature proxy data included not only fossil flora and fauna data from the above-mentioned Hall's Cave in Central Texas, but speleothem data (stalagmite growth rings) from Natural Bridge Caverns, fluvial sediment data from north Texas and Oklahoma, and soil carbonate data from various sites in Texas and southeastern New Mexico. Their modeled temperatures show the same Late Pleisticene warming followed by remarkably stable temperatures throughout the Holocene.

Wong and others also modeled annualized daily precipitation for Texas using similar proxy data (Figure 3.15, right two columns). These data show relatively moist conditions at the end of the Late Pleistocene followed by mixed intervals of brief moist and dry periods, then a long dry period in the Early Archaic. In Texas, this regional drought coincides with an absence of bison in Texas and other parts of the southern Great Plains noted by Dillehay (1974), who compiled archeological observations of bison presence from the plains of Texas and Oklahoma. Dillehay reasoned that bison that primarily lived on the Great Plains came to Texas only when the climate was relatively humid, and that the Early Archaic must have been dry, as no bison remains are found at that period. His findings (also see Collins 1995, 2004) are consistent with Wong and others' precipitation model. Subsequent to the work of Dillehay and Collins, Lohse (2015) has similarly studied the temporal occurrence of bison remains, carefully dating middle and late Holocene archeological sites. His data are compared to the precipitation curve of Wong and others in Chapter 10. Following the relative drought in the Early Archaic, there were discrete periods of bison occurrence that can be roughly correlated to mixed wet and dry

periods in precipitation.

The remarkably stable Texas Holocene climate conditions (notwithstanding a long Early Archaic dry period) as well as the periodic appearance of both bison and bison hunters in the Katy and San Bernard prairies throughout that epoch (Chapters 7 and 8) demonstrate that these prairies were present throughout the Holocene.

Figure 3.16. American mastodon (*Mammut americanum*). Drawing by C. R. Knight, 1896, based on a specimen at the American Museum of Natural History.

## The Late Pleistocene landscape during the Upper Paleolithic

We have no direct evidence of Native Americans in coastal Southeast Texas prior to the arrival of Clovis lithic technology, around 13,500 BP. Nonetheless, excavations at the Friedkin and Gault sites in Bell County, along a tributary of the Brazos in central Texas, have yielded abundant evidence of pre-Clovis occupation least as early as 16,000 years ago, and possibly as early as over 20,000 years ago (Williams et al. 2018; Waters et al. 2011), as have probable human-related lithic and faunal remains at Petronila Creek southwest of Corpus Christi Bay on the Central Coast (Lewis 2009; see Figure 0.2, lower frame). In addition, pre-Clovis remains have been found along the Gulf Coast of Florida at the Page-Ladson site (Halligan et al. 2016), suggesting probable occupation of other parts of the Gulf Coast region that lay between the Gault and Page-Ladson sites. Pre-Clovis sites in Texas and the rest of the Americas have been termed the "Upper Paleolithic" by Williams and Madsden (2019; e.g., Figure 3.15). What did Southeast Texas ecoregions look like at that time?

Cordova and Johnson (2019) studied pollen and phytolith data from stratified intervals at Hall's Cave for a period from 18,000 to about 6,000 BP and concluded that effective moisture was high relative to the Holocene (and today) during the interval from 18,000 to about 13,000 BP—the Late Pleistocene. During this time period, and peaking at about 14,000 BP, they noted from pollen data that the vegetation tended toward forests, and switched to favoring grassland in the Holocene. In the Texas plains outside the higher Edwards Plateau, was this also the case? Hall and Valastro (1995) argued that the High Plains and Edwards Plateau were grasslands at the LGM. Koch and others (2004) used carbon isotope data taken from teeth of Late Pleistocene and Holocene bison and other grazing mammals, coupled with climate modeling, to assess the balance between grassland and forest in Texas for the period since the Last Glacial Maximum (22,000 BP). Among their findings were (1) that isotopic data from bison and other mammalian teeth do not support the existence of widespread forestation beyond present boundaries of the east Texas Pineywoods/Flatwoods, and suggest that the Late Pleistocene pattern of vegetation might resemble that of the present, and (2) that from the results of climate modeling utilized in their report, the annual precipitation in Southeast Texas may not have been appreciably greater than that of today (their Figure 3).

### A Database of Pleistocene Megafauna Fossil Localities

None of the widely spaced mammal fossils tested by Koch and others came from

Southeast Texas, however; they came from central Texas, the Blackland Prairie, and north and west Texas. In order to test their findings in Southeast Texas, and to assess the distribution of forest versus grassland in this region in the late Pleistocene, a compilation of fossil localities of Late Pleistocene "megafauna" was assembled and placed in the project GIS database (Appendix 1). These observations of the locations of various Late Pleistocene grassland vs. woodland megafauna species can give one a very rough, qualitative estimate of grassland versus woodland areas in Southeast Texas, in lieu of more quantitative modeling from proxy data in this area.

In an effort to focus the compilation of megafauna finds on strata of the last glacial cycle (in other words, a time period younger than about 120,000 years; see Chapter 2, Figures 2.5 and 2.6), the data were collected only from published fossil sites from the Late Pleistocene Beaumont Formation in coastal areas, or in time-correlative Deweyville terraces and Quaternary valley fill in upland areas. Fossils coming from Pliocene and older upland areas were excluded. Those Late Pleistocene fossil samples that meet these criteria are shown on the maps of Figures 3.18–3.21. By definition, the artifacts in the megafauna compilation are no younger than about 12,600 BP, the approximate time of the final extinction of mammoths and most other megafauna (Halligan et al. 2016).

Figure 3.17. Columbian mammoth (*Mammuthus columbi*). Drawing by C.R. Knight, 1908.

These data were gathered from a wide variety of sources. Fossil collection in Texas started very early in the history of the state. San Felipe merchant William P. Huff found mammoth, mastodon, ground sloth, and other remains along the Brazos River not far from the town in 1837, displayed them in New Orleans, and sold some to the British Museum, where they drew comments from some of the prominent scientists of the day (Geiser 1945). Fossil mammoths from the Pleistocene were the object of public interest from the time of Thomas Jefferson, who—thinking they might still be alive in the unmapped west—directed explorers Lewis and Clark to keep an eye out for them. By 1924 Carnegie Institute vertebrate paleontologist Oliver Hay was able to compile a massive paleontological volume listing all known Pleistocene fauna fossil sites of North America, building upon the work of legions of early collectors (Hay 1924). In the middle and late twentieth century, fossil sites in Southeast Texas were churned up by developers, by flood control efforts along Houston and other city waterways, and even by dredging the spoil piles of the Texas City dike, where they were studied by local science museum paleontologists and by private collectors and enthusiasts like the George Wolf Sr. family. Data sources are listed in Appendix 1.

Part of the great interest in these Pleistocene animals is that they were here in North America until only a very short time ago—accompanying early humans in the area—and yet these were in many cases very large and unique beasts. These "megafauna" included animals like mammoths, mastodons, giant ground sloths, camels, horses, short-faced bears, gomphotheres, glyptodons, giant beavers, dire wolves, saber-toothed cats, and large tapirs. All but bison, deer, black bear and

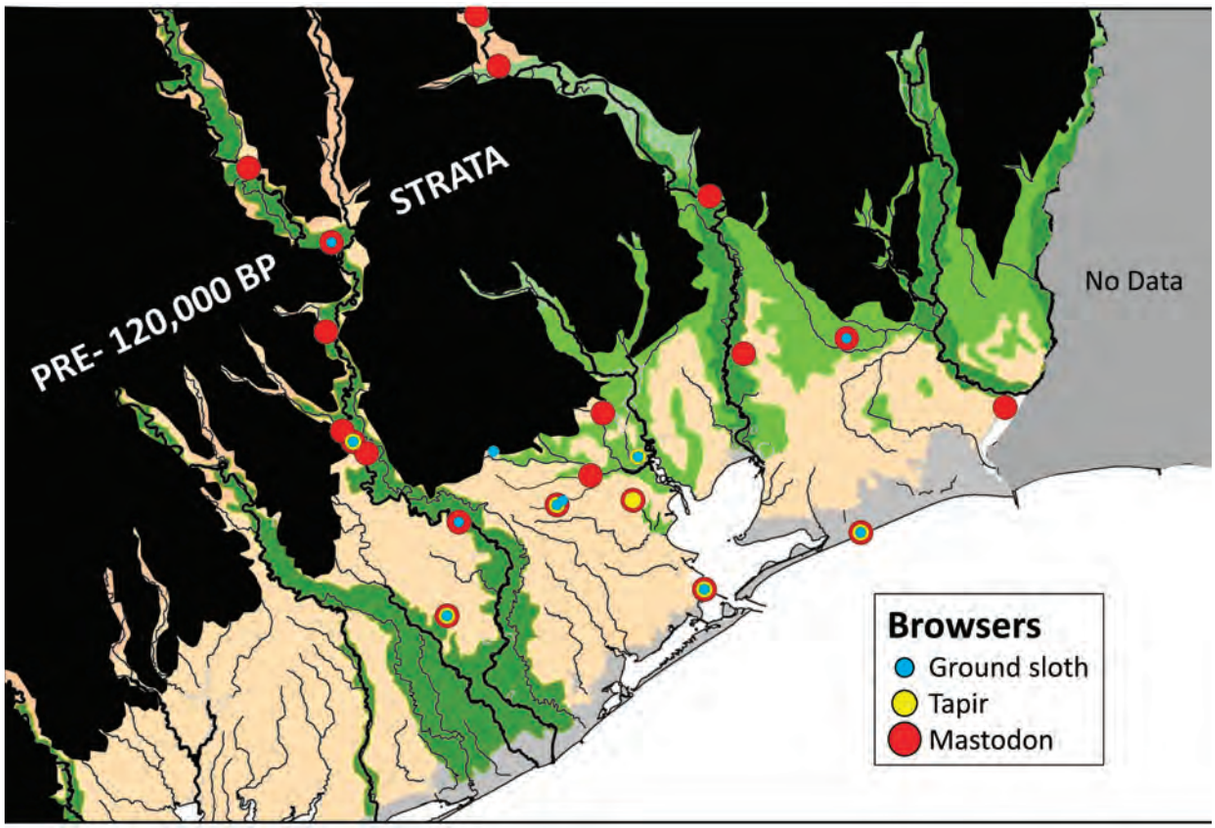



Figure 3.18. Locations of fossil sites with evidence of Late Pleistocene browsers, superimposed upon the ecoregions map of Figure 3.7. Areas where the geologic substrate is older than the last full glacial cycle (pre-120,000 BP) are masked with black.

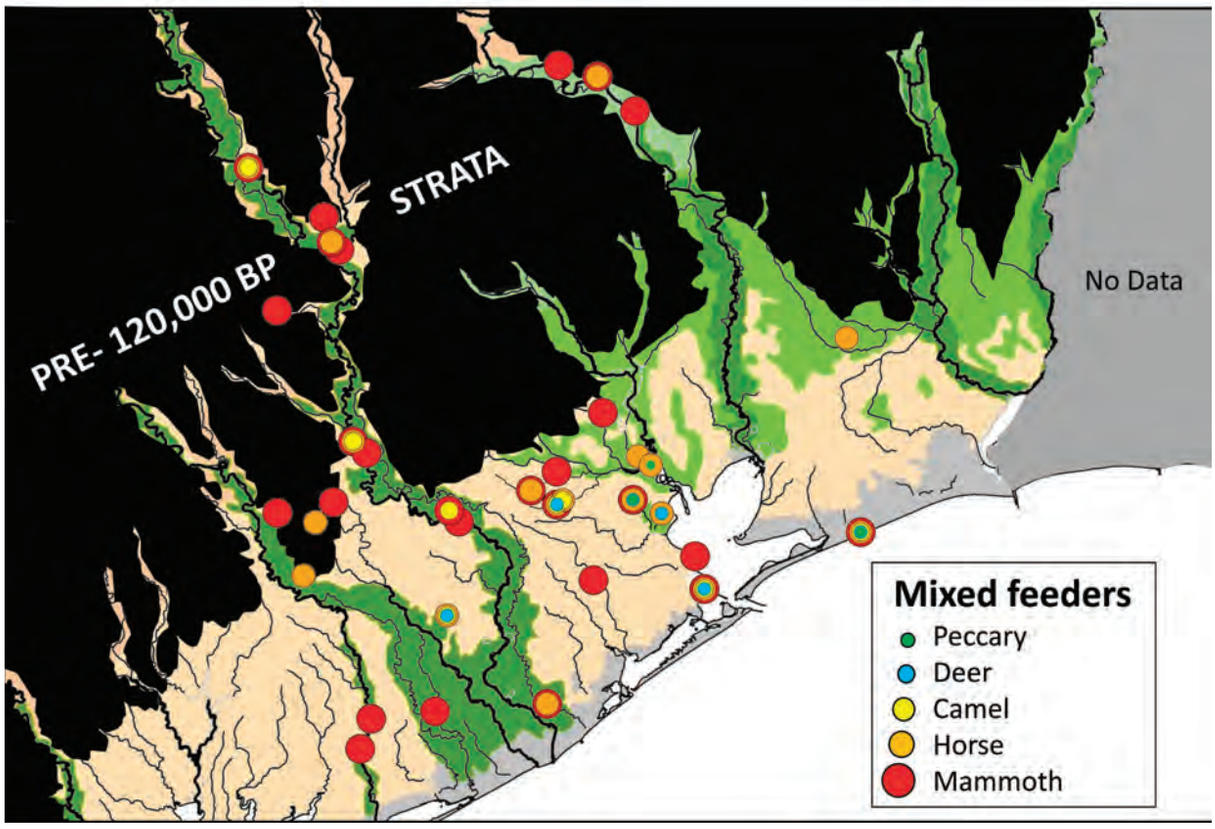





Figure 3.19. Locations of fossil sites with evidence of Late Pleistocene mixed feeders (grasses and woody plant parts) , superimposed upon the ecoregions map of Figure 3.7.

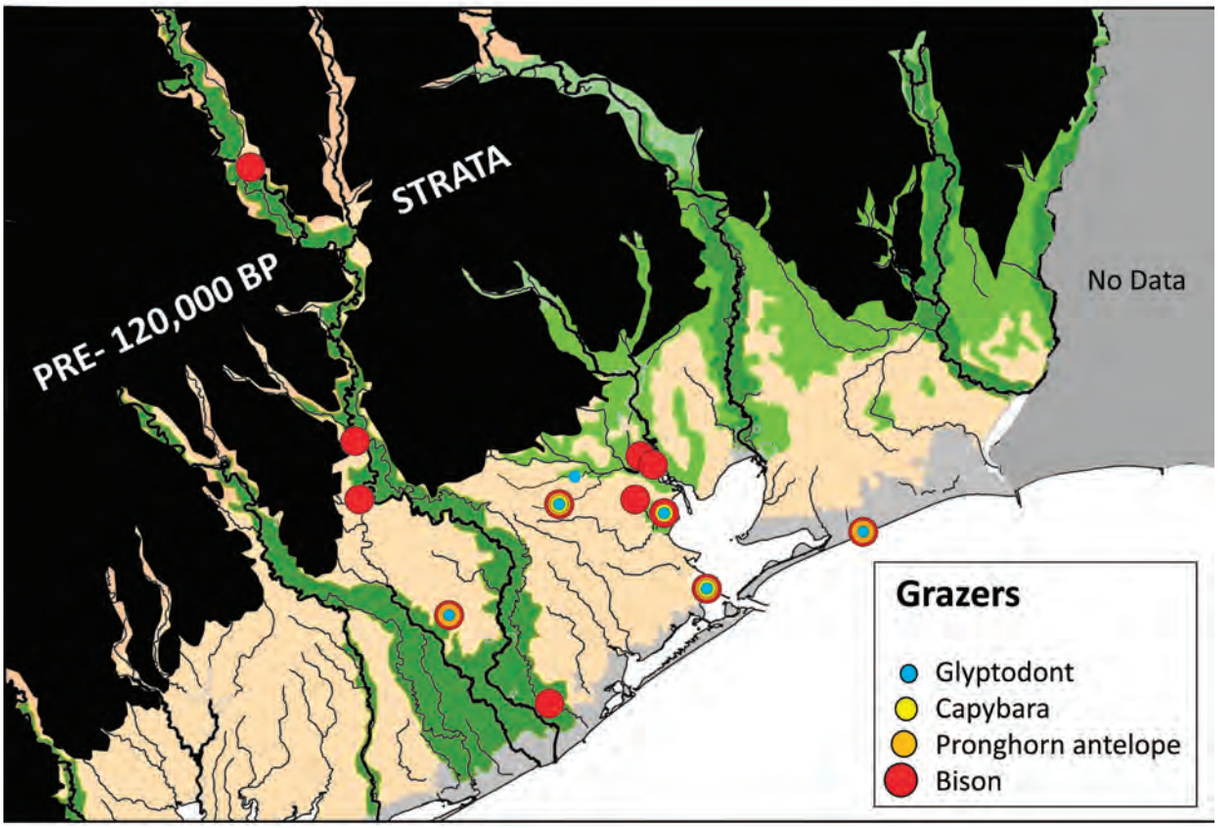



Figure 3.20. Locations of fossil sites with evidence of Late Pleistocene grazers , superimposed upon the ecoregions map of Figure 3.7.

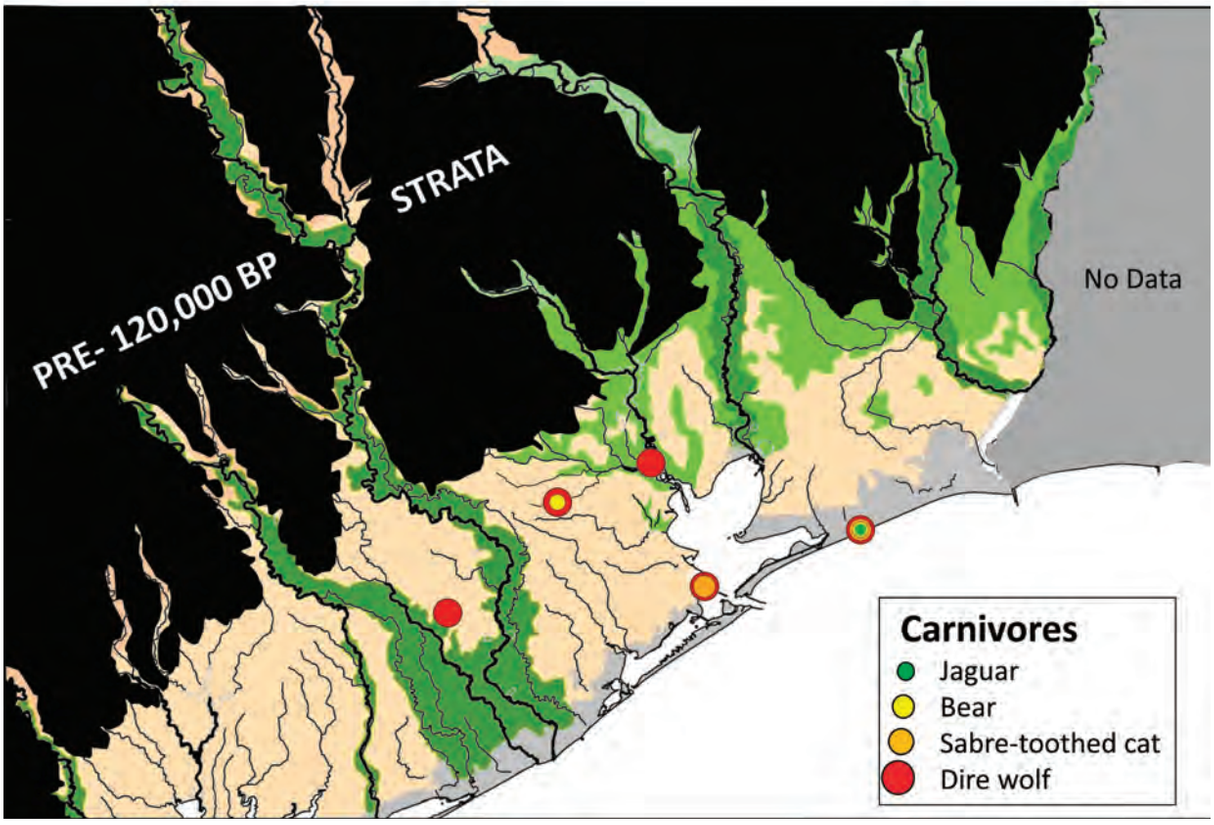



Figure 3.21. Locations of fossil sites with evidence of Late Pleistocene carnivores, superimposed upon the ecoregions map of Figure 3.7.

antelope were to become extinct by the end of the Pleistocene. By the late twentieth century many scientists began collecting data that tied megafaunal extinctions to Clovis culture; both the signature Clovis projectile points and the last of the Pleistocene megafauna disappeared by about 12,600 BP (Martin 1967). Others cite a cooling climate as a key environmental factor, and still others consider the extinction event as due to both causes (Koch and Barnosky 2006).

Among these megafauna were browsers, found in the forest and savannah; grazers, found in grasslands; mixed diet herbivores that ate from both ecosystems; and carnivores. Given enough fossil material at enough sites, one may make some qualitative deductions about the extent of either grasslands or forests at the end of the Pleistocene. The localities with fossils of three browsers— mastodons, tapirs, and ground sloths—are shown in the map of Figure 3.18, which superimposes the sites over the previously discussed pre-settlement map of Texas ecosystems (from Figure 3.7), but excludes areas where geologic strata are thought older than 120,000 BP. There are a significant number of fossil sites, and nearly all of them that include browsers are located where there were forests in the recent past: principally, in river floodplain forests and in the East Texas Forest (locally, Flatwoods/Big Thicket), as well as in areas along small wooded streams. One can reasonably assume that these same areas were forested in the Late Pleistocene. Figure 3.19, which shows locations of "mixed feeders" that could eat both prairie grasses and leaves from woody forest plants, includes mammoths, extinct Pleistocene horses, several types of camels, peccary (now locally extinct), and deer (still present). Mammoths were common, or at least their large bones were more commonly preserved, and tend to be found, like the mastodon fossils, along modern day forested rivers and streams. At these sites, these lumbering animals could feast on both nearby ecosystems—prairie and forest. The other four types of mixed feeders have similar distributions. It is difficult to say anything substantial about their distribution except that a mixed environment of forests and grasslands was likely present.

Four megafauna types that were typically grassland feeders are shown in Figure 3.20: large Pleistocene bison, now extinct; pronghorn antelope, locally extinct; the large capybara (rodent), locally extinct but still present in South America; and glyptodonts, large low armored beasts, now extinct, that were somewhat like horned armadillos. Examining the spread of fossil sites, it is apparent that there are relatively fewer of their fossils found in forested areas such as bottomland forests and flatwoods, and somewhat more on what were prairie grasslands in the early Historic Period, supporting the existence of at least some prairies here in coastal Texas even during the wetter days of the Late Pleistocene. Carnivores are slightly skewed toward prairie areas (Figure 3.21).

All in all, these megafauna fossil sites tend to support the concept of a Pleistocene landscape of forests in humid east Texas with grasslands to the west and southwest, as well as forested rivers and streams—in other words, something like the pre-settlement ecoregions of Figure 3.7. It is possible, of course, that the bottomland and flatwoods forests were more expansive than they area now, as might indeed be expected in a cooler and wetter climate. Current data do not allow extrapolating into the now submerged shelf, but it would seem reasonable to assume that the mix of riparian forests and coastal grasslands, extending toward coastal marshes, that

is seen in the modern coastal region extended across the exposed continental shelf during much of the Late Pleistocene (Figure 0.2).

## Summary

A reconstruction of the region's vegetated landscape just prior to European settlement (Figure 3.7) contains a mix of prairies, riparian forests, and—in humid areas of Southeast Texas—extensive forests. Much of the east Texas loblolly pine forest of today once took the form of longleaf pine savannah, with understories of woody brush removed by frequent fire. Such early landscapes were maintained by frequent burning, either caused by natural lightning or—as considerable historical data demonstrate—by Native Americans who used burning both for hunting purposes and (probably) to keep transportation routes open. Historical accounts are abundant for the Native American use of fire for hunting in North American prairies, including in Texas.

A brief study of Late Pleistocene megafauna suggests that Southeast Texas was then, as today, a mix of forest and prairie. In the Holocene it would appear that frequent prairie burning, especially in more humid sections of the eastern part of the Southeast Texas study area, kept these prairies open and free of woody incursions. The wide open, extensive prairies that met the first Anglo Americans and African Americans were, at least in part, already a managed landscape.

An interpretation of an Archaic Pertiod bison hunt at a bluff overlooking West Bernard Creek, San Bernard Prairie. Woodcut by Barbara Whitehead.

# Part II
# The Human Landscape

# 4.

# Indigenous people of Southeast Texas during the early Historic Period

The western Atakapa, including the Akokisa, the Bidai, and the Atakapa "proper" bands, as well as the Coco band of the Karankawa, comprised the major Native American presence in Southeast Texas in the early Historic period, and then all but vanished, due largely to epidemic diseases during the phase of Spanish and French visits and occupation as well as forcible displacement by Anglo Texan colonists. There is a rich trove of ethnohistorical material on these vanished Native Americans that was written by early Spanish, French, and Anglo visitors to Southeast Texas.

These accounts are important in helping give context to the lithic, shell, and bone artifacts encountered at archeological sites. Such collected archeological materials tell us much about the habits of the people who left them behind, but there are important deficiencies. Most obvious is the dearth of softer materials, which quickly disintegrate in the humid Southeast Texas climate. Historical members of these groups lived in temporary shelters of sticks and hides, fished with lines and weirs, collected food with cane baskets, poled around the rivers in log boats, and used blowguns as an adjunct to the bow and arrow (Newcomb 1961; Kniffen et al. 1987). None of these historical era "soft" items, which are so prominently discussed in the accounts of early visitors, is present in prehistoric archeological sites of humid Southeast Texas. It is also difficult, using collected "hard" items alone, to ascertain cultural information about these prehistoric people, regarding social activities like music and dance, spiritual life, and interactions with other groups at their periph-

ery—including intermarriage, warfare, trade, and technology transfer. By gleaning such information from early historical accounts for the main groups of Southeast Texas, better inferences can be made about the actions of prehistoric groups in the region, especially where great cultural continuity over time is suspected based on information from the archeological sites themselves. In this chapter this ethnohistorical record is reviewed, to be used in subsequent chapters where the older archeological record is interpreted.

Figure 4.1. Major Native American cultural groups, ca. 1700, modified from Swanton (1911, 1952). Boundaries are superimposed upon a map of river drainage basins, as shown in Figure 1.3.

## Cultural Groups of the Early Historic Period

The approximate cultural boundaries of major Native American groups at the dawn of significant European incursions into this area, ca. 1700, shown in Figure 4.1, are modified slightly from those compiled by ethnologist John Swanton (1911, 1952). These prominent ethnic boundaries are superimposed on a map of drainage basins of the region that was discussed earlier (Figure 1.3). The Atakapa and Karankawan areas are further subdivided (with dashed lines) into approximate areas of intratribal bands, discussed below.

### Atakapa

The principal tribal group in Southeast Texas, extending into southwestern Louisiana, was the Atakapa, a coastal hunter-gatherer group that is all but extinct today as a tribal entity. A few hundred descendants, mostly living in Louisiana, have established descent from the Atakapa and are attempting to reorganize as the Atakapa-Ishak (Atakapa-Ishak Nation 2019).

The Atakapa lived in the coastal portions of the San Jacinto, Trinity, Sabine-Neches, Calcasieu, Mermentau, and Vermilion river basins, where they fished along the rivers and adjacent coast, and travelled to inland prairies to hunt bison and deer. They adapted to the humid and quiet backwater environments in these small drainage basins, and their diet consisted largely of fish, turtles, and alligators, along with deer and small mammals. As was mentioned previously, these rivers (excepting the Vermilion) were all once part of the larger paleo-Sabine river basin, and its various former tributaries had been separated by rising sea level in the Archaic Period. The fact that the Historic Period bands who inhabited these rivers spoke dialects of the same Atakapan tongue, plus the fact that many archeological sites of the region show long occupations with little evidence of cultural change, suggest that these Atakapan bands have lived more or less in place for millennia.

Among major Texas Indian groups, the Atakapa of Southeast Texas seem one of the least well known (Newcomb 1961). An image of an Atakapan man holding a calumet (a decorated ceremonial pipe) drawn in Louisiana in 1735 by French artist Alexandre DeBatz, constitutes the only known early image of this cultural group (Figure 4.2). Decimated by European diseases in the 17th and 18th centuries, few Atakapans remained when Stephen F. Austin's colonists began arriving in 1822. For this reason, few eyewitness accounts in English exist for Texas Atakapa. In contrast, there are much more numerous accounts of the Karankawa—who made a violent last stand on the central Texas coast against Stephen F. Austin's settlers—and of interior plains tribes like the Comanche and Tonkawa, and of Caddoan people of

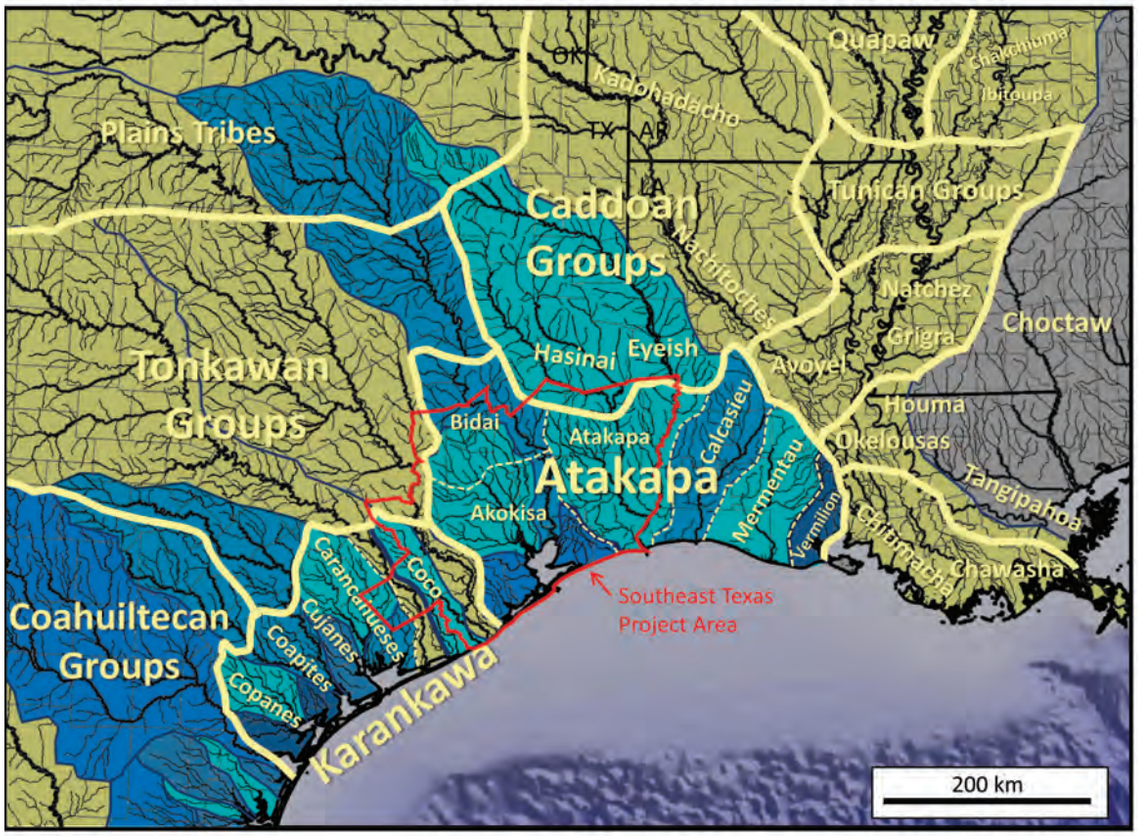
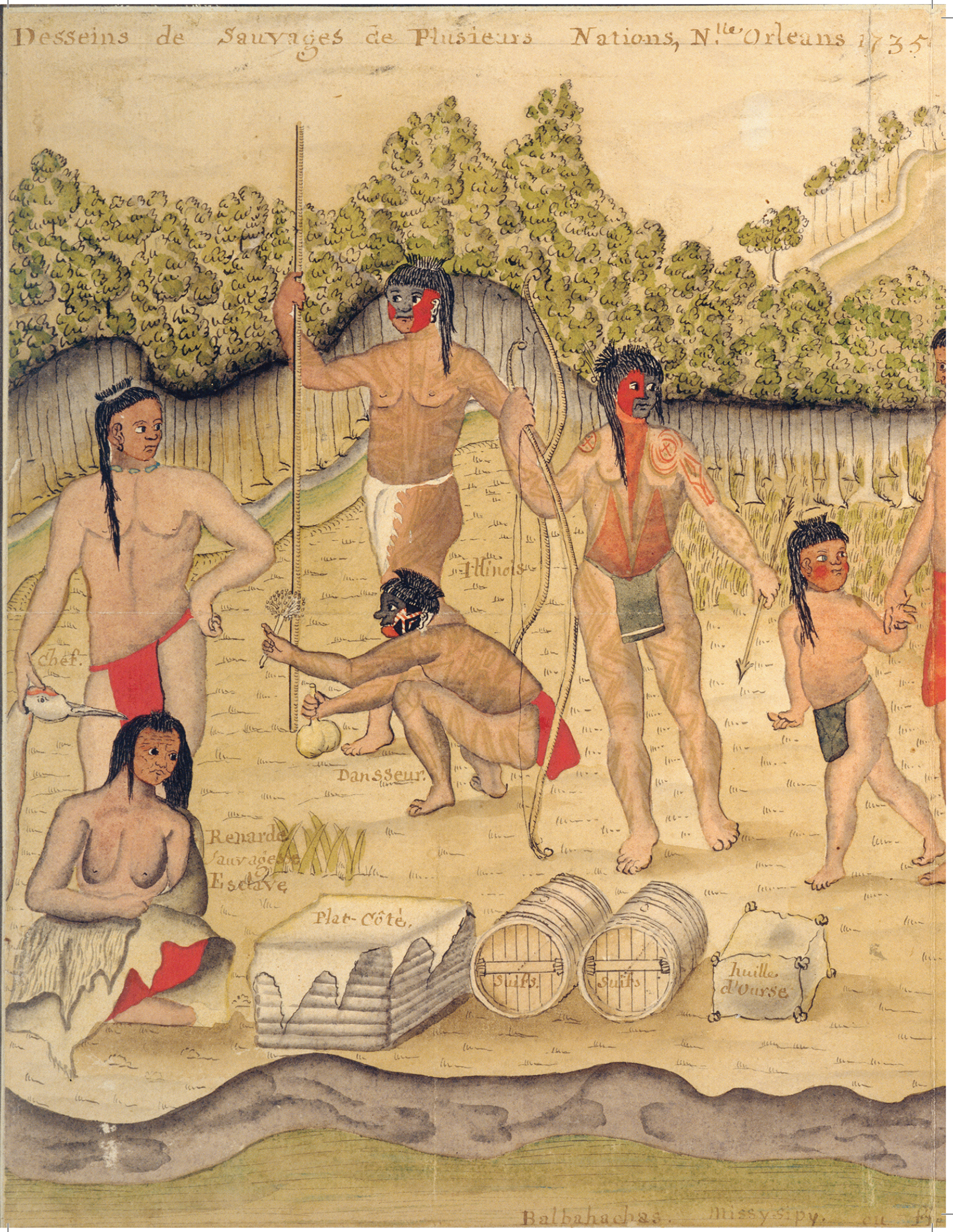


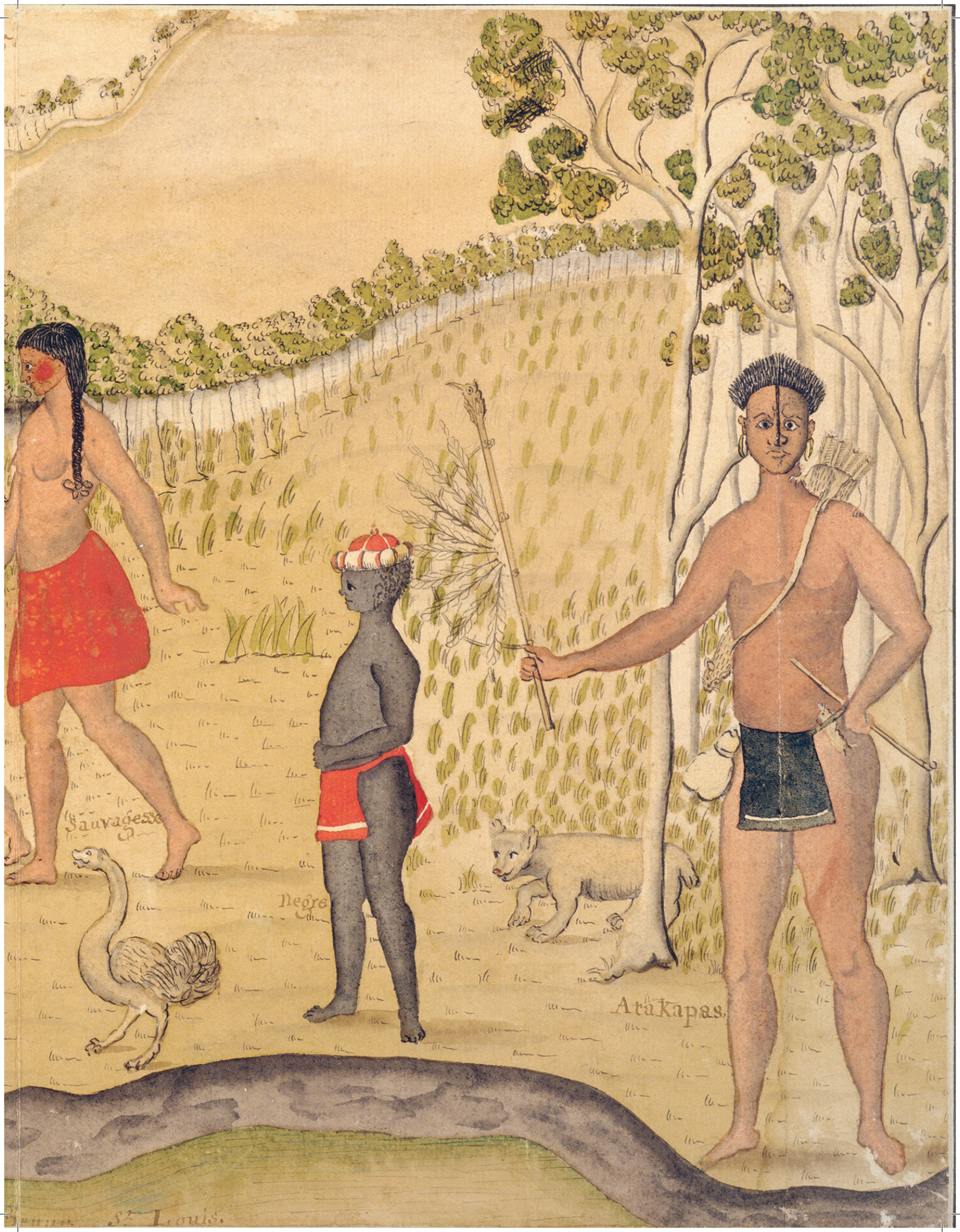

Figure 4.2 (next page). Watercolor image of a group of Native Americans on the bank of the Mississippi River at New Orleans, 1735, painted by Alexandre DeBatz. An Illinois chief, at left, stands behind an enslaved Fox woman. Other Illinois men and woman and a child display red ochre on their faces and an assortment of tattoos. On the right are an African American boy and an Atakapa warrior, the only known image attributed to this tribe painted from life. He is wearing a loin cloth and is carrying a calumet (a decorated ceremonial pipe) in his right hand, a more everyday pipe in his left, and a quiver of arrows across his back. His hair is tonsured, and his face is tattooed. Indian trade goods lining the bank are, from left to right, a pile of animal skins (prob-ably deer), two barrels of tallow, and a box containing bear grease. Courtesy the Peabody Museum of Archaeology and Ethnology, Harvard University, PM 41-72-10/20. Gift of the Estate of Belle J. Bushnell, 1941.

northeast Texas and western Louisiana. Fortunately, there are numerous descriptions of Atakapans in the accounts of Spanish and French visitors in the 16th, 17th, and 18th centuries. Herbert Bolton's 1913 work *Spanish Activities on the Lower Trinity River*, and another published in 1915 concerning Spanish colonial administration, are especially useful historical references, as is F. Todd Smith's 2005 study on the disappearance of Indians in Texas over the period 1786–1859.

In 1911 the ethnologist John Swanton published a brief sketch of the few remaining Atakapa that he could find, and in 1932 Albert Gatschet and Swanton published *A Dictionary for the Atakapa Language*, compiled with the aid of the last known handful of Atakapa speakers. The language is now extinct. Atakapan is considered a language isolate, with no close lingual ties to the spoken languages of adjacent tribes (Kaufman 2014). A few modern day artifacts of everyday living have been preserved by the Smithsonian, in particular a collection of 19th-century split cane baskets (Figure 4.3), but there is little physical evidence today of their long tenure in the Southeast Texas and southwestern Louisiana landscape.

The Atakapa were a riverine people, meaning that they lived near the banks of the rivers and streams of the region. Both historical and archeological records clearly establish this pattern of residence. Figure 4.4 displays both known historical occupation sites in Southeast Texas (in orange), details for which are discussed in this chapter and documented further in Figure 4.10, as well as the youngest archeological sites from the project archeological database (in red), outlined in Chapter 5. The archeological sites shown are from the Late Prehistoric and early Historic Periods, ca. AD 600 to AD 1750. These various sites—the last known places where these ancient people lived—are almost entirely clustered along the area's rivers, creeks,


Desseins de Sauvages de Plusieurs Nations, N.lle Orleans 1735
Illinois
Chef.
Dansseur.
Renarde
Sauvagesse
Esclave
Plat-Côté.
Suifs.
Suifs
huille d'Ourse
Balbahachas.
Missy-sipy.


Sauvagesse
Negre
Arakapas.
St Louis.

and bayous, including the mouths where some of these waterways reached the Gulf of Mexico and its bays. The rivers and streams where the Atakapa lived are shaded in blue.

The six main Atakapan bands were each clustered along their own coastal rivers. The Akokisa band lived along various parts of the San Jacinto and lower Trinity river basins, including the areas near the mouths of those rivers in Galveston Bay (Figure 4.4). As mentioned in Chapter 2, although the San Jacinto and Trinity today drain separately into Galveston Bay, not very long ago in the middle Holocene, when global sea level was lower, they were tributaries of the same larger river system, as is shown on that figure with blue dashed lines.

The Bidai lived along Bedais Creek and the upper Trinity River basin; Aten (1983) contended that they extended no farther south along the Trinity than the town of Livingston. Spanish sources report locations of Bidai and Atakapan winter camps on the Katy and Grimes prairies (more on this later). The Atakapa "proper" lived in the Sabine and Neches river basins; the Spanish referred to those living along those two rivers with this name. As shown in Figure 4.1, the Calcasieu, Mermentau, and Vermilion bands lived in the river basins of those names in southwest Louisiana (Swanton 1911). Of other Spanish period groups considered Atakapa, the Deadose and the Patira, little is known beyond a few references in Spanish manuscripts (Bolton 1970 [1915]); they disappeared during the 18th century.

The distribution of the various Atakapa bands by drainage basins is not unique. Archeologists Anderson and Hanson (1988; also Anderson and Sassaman 1996) developed a cultural "band-macroband" model to describe how Native American hunter-gatherers in the coastal Carolina Piedmont during the Archaic Period would separate into bands along separate coastal rivers during the year, migrating within each drainage basin from the coast to the interior during various seasons as resources became available (ripening nuts in the fall, etc.). These bands were joined by kinship and trade into "macrobands" that are similar to the early Historic Period organization of the Atakapa.

The rivers, bayous, and creeks that were home to Atakapa are highlighted in blue in Figure 4.4. While nearly all occupations in the recent past were along waterways or their coastal mouths, not all waterways were occupied. For example, although Cypress Creek is home to many archeological and Historic Period sites, nearby Spring Creek is nearly devoid of such sites. The lower San Jacinto River was occupied, but its upper branches (excepting Cypress Creek and parts of Lake Creek) have not generally been places where human remains have been excavated. Unlike the San Jacinto, the nearby Trinity River has been occupied all along its length, even extending farther north from the map area. *All* of these waterways contain the basics—water, firewood, and materials for building shelter—but only some of

Figure 4.3. Atakapan baskets from Calcasieu Parish, Louisiana, sent to Smithsonian Institution in 1893. They are made of split cane, with black and red dye. Photographs courtesy of the Department of An-thropology, Smithsonian Institution.

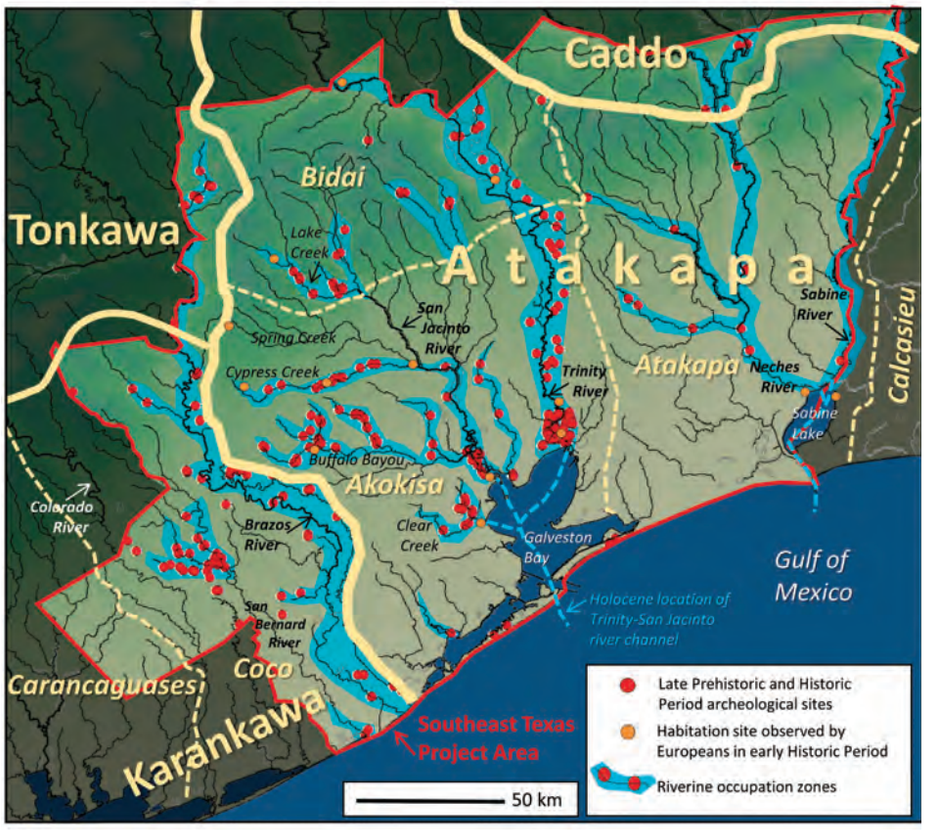



Figure 4.4. Late Prehistoric through early Historic Period archeological sites (red; ca. A.D. 600–A.D. 1750) and locations of Native American settlements observed by European visitors during the early Historic Peri-od (orange) in the study area. Details of settlement sites are given in this chapter 4 and in Figure 4.10. Riverine areas showing evidence of settlement are highlighted with blue shading.

them appear to have been significantly occupied, indicating that more than just those three things was required to attract semi-permanent or even occasional but repeated habitation. The landscape setting of various ecoregions was paramount in determining which watercourses were surrounded by ample opportunities for obtaining food. Rivers and creeks near coastal areas offered brackish water clams and access to brackish water and bay fishing. Large rivers like the Trinity, Neches, and Sabine—and also the Brazos and Colorado—had fish and alligators, broad floodplains that were mostly forested but partly open and thus good hunting sites, and of course the possibility for river transport by large dugout canoes (Chapter 6). Smaller streams were extensively used where surrounded or partly surrounded by adjacent prairie, especially where those streams offered possibilities for communal hunting of bison or deer; examples are Cypress Creek, the upper tributaries of Buffalo Bayou including White Oak Bayou, several creeks in the San Bernard Prairie, and parts of Lake Creek (see Chapter 8). Creeks transecting the deep forests of the Big Thicket or Pineywoods were typically not the home of significant occupations, because the potential to fish or hunt there was significantly less than in the aforementioned environments.

There are other factors than food that affect the observed density of archeological sites along waterways in the region, however. While there seems to be a high density of sites on the Trinity River in the Akokisa and Bidai areas, density of sites is much lower on the equally large Neches and Sabine rivers in the Historic Period home of the Atakapa "proper" band. This discrepancy may partly be sampling bias, due to the distance of those two rivers from the city of Houston, home of most

members of the Houston Archeological Society. Sites far from home appear to attract less interest from avocational members who typically invest their weekends in such activities. That and other types of data sampling biases are discussed in Chapter 5.

## Karankawa and Coco

The Karankawa, like the Atakapa, were a cultural group comprising several bands of coastal hunter-gatherers. These bands resided along separate bays or within the drainage basins of small coastal rivers (Figure 4.1). Their northeasternmost band, the Coco, lived along the coastal deltas of the Colorado and Brazos rivers as well as the small San Bernard River that lies between those larger rivers. Besides the Coco, there were four other bands of Karankawa known to the Spanish; these bands occupied bays and coastal rivers farther down the coast: the Carancahueses (Karanakawa proper), Cujanes, Coapites, and Copanes (Ricklis 1996). It seems likely that the various Karankawa bands each had riverine and bay-oriented territories, but the details of those assumed boundaries have not been recorded. The Karankawan language is known only from a group of words recorded by a Mrs. Alice Oliver, who grew up near a small group in the 1830s; it is unlike that of the language of any of the surrounding cultures and is assumed to be an isolate (Gatschet 1891).

The Karankawa, including the Coco band, were violently displaced by settlers of Stephen F. Austin's colony during a series of bloody skirmishes in the early 19th century (below). Jean-Louis Berlandier, a French-Mexican naturalist, visited the Texas coast several times during that troubled period and made the only known

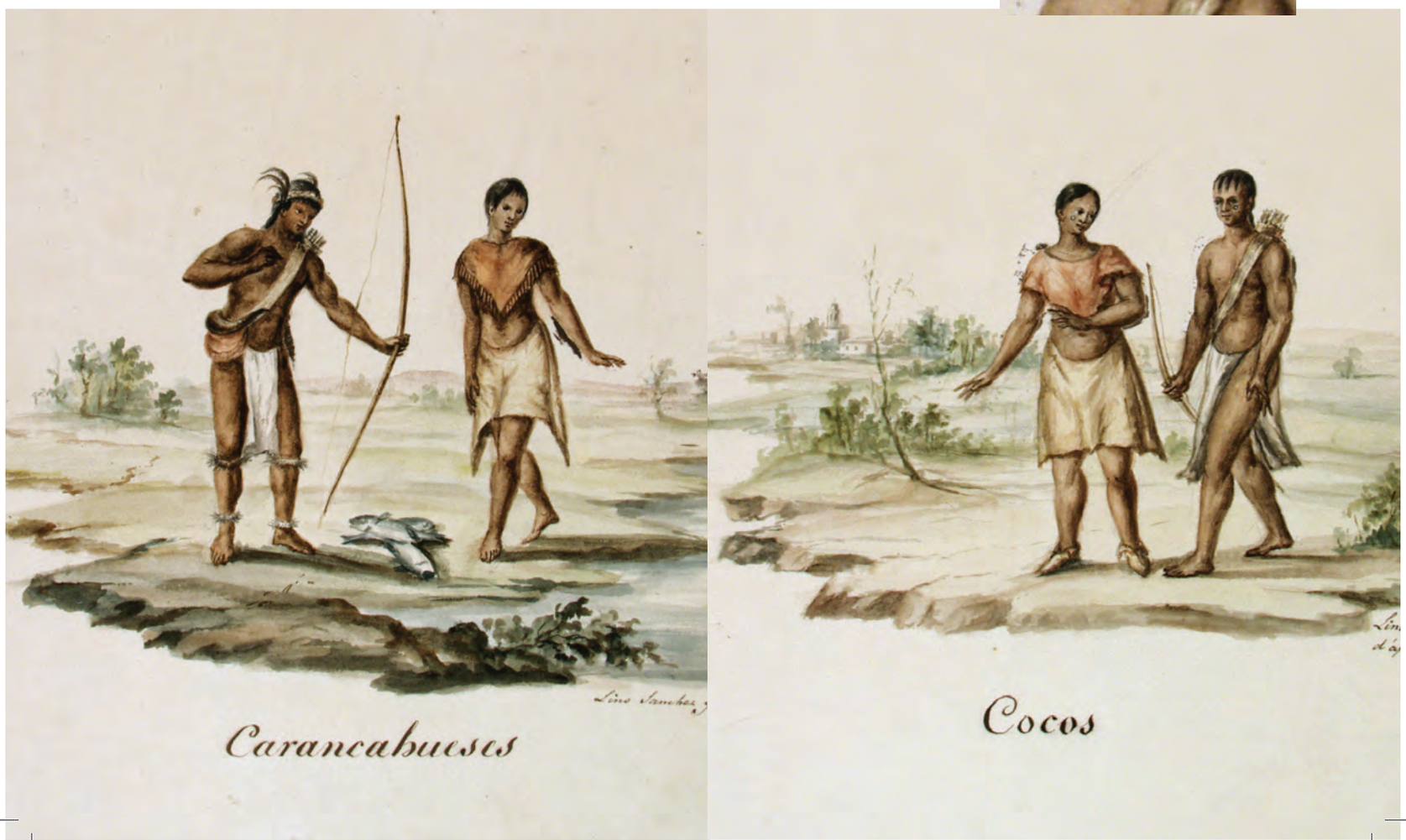



Figure 4.5. Watercolors of Karanka-wa Indians drawn by Lino Sánchez y Tapia from sketches made near Goliad by Jean-Louis Berlandier in 1829. Left, two members of the *Carancahueses* (Karankawa proper) band, with fish that made up much of their diet. Right, two members of the Coco band. The enlargement highlights their distinct circular facial tattoos, noted by several visitors of that era. Note the Goliad mission church in the background of the Coco image. Courtesy of the Gilcrease Museum, Tulsa, Oklahoma.

drawings of Karankawa people (Figure 4.5). The Karankawa and the Coco had a similar appearance. The men were tall and muscular, wore breechcloths, and carried bows that were as long as they were tall. Women wore simple deerskin skirts; the tops shown in the drawings are probably a result of the influence of Spanish mission culture, as they did not use tops in previous times. They were known for circular tattoos on their cheeks, as shown in the enlargement.

## Tonkawa

To the west of the Atakapa were the Tonkawa, a nomadic plains tribe who hunted bison and deer in the central Texas region (Figure 4.1). They were known in Spanish times to occupy the prairie and savannah inland of the coastal zones of the Karankawa and Atakapa, including inland portions of the Guadalupe, Colorado, Brazos, and Trinity drainage basins (Jones 1969). Their cultural origins are obscure. Once thought to have been descended from the central Texas Late Prehistoric Period "Toyah" culture (Jelks 1962), they are now thought to have migrated into central and south-central Texas from the high plains in the seventeenth century, and grew as an aggregation of independent smaller cultural groups that united in the eighteenth century (Carlisle 2010). In spite of their significant assistance to the Republic of Texas in wars with the Comanche, they were removed to a north-central Texas reservation in 1855 and to the Wichita Indian Agency in Oklahoma 1859. In 1862 at that site they were massacred in an attack by traditional enemies of the Comanche, Kiowa, Caddo, Shawnee, and other groups (Jones 1969). The few survivors ultimately moved to nearby Fort Griffin, Texas, and by 1884 moved to a reservation in Oklahoma, where a small group of descendants live today (La Vere 2004).

Figure 4.6. Tonkawan man, ca. 1865–72. Photograph by Henry S. Shuster. Courtesy of DeGolyer Library, Southern Methodist University, Lawrence T. Jones III Texas Photographs. Note the string of circular medallions made of *Busycon* (lightning whelk) shells; see prehistoric examples in Chapter 11.

A group of photographs of Tonkawa taken by Henry Shuster in the late 1860s and early 1870s at Fort Griffin and other locations has survived. Figure 4.6 shows a Tonkawan man in traditional attire. Figure 4.7 shows their typical Plains tipi dwellings, well designed for a nomadic life of following the bison, which provided most of their needs. In the 1770s Spanish visitor Athanase de Mézières described their reliance on the bison as follows:

> *In truth, one cannot exaggerate the inestimate benefits for which these natives are indebted to divine providence. The buffalo alone, besides its flesh, which takes first place among healthful and savory meats, supplies them liberally with whatever they desire in the way of conveniences. The brains they use to soften skins; the horns for spoons and drinking vessels; the shoulder bones to dig and clear off the*

Figure 4.7. Tonkawan encampment at Fort Griffin, Texas, 1873. Courte-sy of DeGolyer Library, Southern Methodist University, Lawrence T. Jones III Texas Photographs.

*land; the tendons for thread and for bow-strings; the hoof, as glue for arrows; from the mane they make ropes and girths; from the wool, garters, belts, and various ornaments. The skin furnishes harness, lassos, shields, tents, shirts, leggings, shoes, and blankets for protection against the cold—truly valuable treasures, easily acquired, quietly possessed, and lightly missed, which liberally supply an infinite number of people, whom we consider poverty-stricken, with an excess of those necessities which perpetuate our struggles, anxieties, and discords.* (Bolton 1914)

## Caddo

To the north of the Atakapa were the Caddo, a Woodland cultural group who lived in northeast Texas, northwest Louisiana, and southwest Arkansas, especially in the river valleys of the upper Red, Sabine, and Neches rivers. A comparison of their approximate territorial boundaries of 1700 (Figure 4.1, as drawn by Swanton 1911, 1952) and the forest cover map of Figure 1.2 shows that they lived chiefly in the East Texas forest. Significant bands or "confederacies" (Figure 4.1) included the Hasinai and the Eyeish on their southern border, near modern Nacogdoches; Nachitoches in northwestern Louisiana; and the Kadohadacho in southwest Arkansas (Swanton 1952: plate 1). In the mid-nineteenth century the Caddo were relocated onto a reservation on the Brazos River, and in 1859 they were again forced to relocate, to Oklahoma, where descendants of the tribe live today. The Caddo are thought to have descended from the Fourche Maline culture of southeastern Oklahoma and southwestern Arkansas (Story 1990). Archeological data suggest that they then expanded southward into the drainage basins of the Sabine-Neches and Trinity rivers (Chapter 11).

Figure 4.9. Caddo bottle, date unknown but acquired in 1871, from Upshur County, Texas. Courtesy of the National Museum of Natural History, Smithsonian Institution.

During the early Historic Period the Caddo were predominantly agricultural, unlike the three previously described tribes. They grew maize, squash, beans, sunflowers, and other plants and lived in villages with permanent thatched houses (Figure 4.8). They were and are well known for their pottery, and many prehistoric

examples have been found at archeological sites, often associated with burials (Perttula 1992; Figure 4.9). Although they were primarily agricultural woodland-dwellers, they clearly appreciated the value of the bison that roamed in the prairies to their west, and like other cultural groups of the East Texas forest would venture far into the surrounding Texas plains to hunt them (Chapter 7).

Figure 4.8. Caddo family compound near Binger, Oklahoma, ca. 1870. The Caddo were forcibly relocated to Oklahoma in 1855 but retained their traditional style of home construction for a while in their new environment. These houses closely resemble drawings made by Spanish visitors in the 1600s. Photograph by William Soule, courtesy of the Smithsonian Institution.

## Other groups

To the east of the Atakapa, beyond southwestern Louisiana were various tribes of the Lower Mississippi Valley (Figure 4.1). The Chitimacha, another coastal hunter-gatherer group, lived along the southern Louisiana coast, including the Atchafalaya Basin and Bayou Teche. They shared many lifestyle features and types of cultural artifacts with the coastal Atakapa to the west (Swanton 1911). After resisting French incursions in the early eighteenth century, they adopted agriculture during the French period (Kniffen et al. 1987). A considerable variety of their historical era cultural artifacts have survived in Smithsonian Institution collections, such as baskets, blow darts, a wooden mortar and pestle, and bows and arrows. Many tribal members today live on a reservation at Clarenton, Louisiana, where a few still weave traditional split cane baskets, for which tribal members—like their former Atakapa neighbors to the west—have been well known (Chitimacha Tribe 2020).

The modern Alabama-Coushatta tribe, with its modern day Polk County reservation, entered East and parts of Southeast Texas only in the late 18th and early 19th centuries, having been pushed out of the southeastern United States by advancing Anglo settlement (La Vere 2004). They are not shown on Swanton's map of 1700 Texas (Figure 4.1), as they had not yet arrived by 1700, and they play no role in the area's prehistory.

## Accounts of European visitors during the Early Historic Period

There are five main periods of observation of Native American groups of Southeast Texas by Europeans: (1) the visit of Cabeza de Vaca, who was shipwrecked with his companions on the coast below Galveston in 1528; (2) the visit of René-Robert Cavelier, Sieur de La Salle, to the central Texas coast in 1685–1687, especially the records of his lieutenant, Henri Joutel; (3) the colonial era of Spanish and French expeditions to the region (1688–1803), as they contested sovereignty over East and Southeast Texas, an era that includes the time of catastrophic collapse of Akokisa and Bidai populations from European diseases; (4) the time of the last sightings of organized Native American groups in the Southeast Texas region (1803–1900), as recorded primarily by early Anglo American settlers; and (5) the beginning of scientific study by ethnologists and linguists in the late 19th and early 20th centuries, when the last speakers of local Native American languages were interviewed.

The discussion here of the Historical Period focuses on first-hand descriptions of indigenous people encountered by early Europeans, rather than on the actions of the Europeans themselves as they jockeyed for position in ownership of the region. The history of European activities of this period is well summarized by Bolton (1970 [1915]) and Weddle (1985, 1987, 1991), to which the reader is referred for more information on French and Spanish visits to the region. The locations of early Historic Period sites and trails discussed in the text are shown in Figure 4.10.

## Cabeza de Vaca's encounters with coastal people, 1528

Cabeza de Vaca and his shipwrecked companions landed on the Texas coast in 1528 as a result of the disastrous voyage of Pánfilo de Narváez, who had been charged to explore the Gulf Coast west of the Florida cape. Although the landing site is typically cited as Galveston Island, more recent research places the landing at Follett's Island, across San Luis Pass to the southwest of Galveston Island (Location 1, Figure 4.10; see Weddle 1985; Carson 2019a). There de Vaca encountered two cultural groups, the Coaques (also called Capoques) and the Han, who co-inhabited the small island but lived in different camps and spoke different languages. Most historians have considered the two groups as the Coco (the northeasternmost band of the Karankawa) and the Akokisa band of the Atakapa (e.g., see Hodge 1907). The location of Follett's Island correlates well with the ethnological boundary between the Coco and Akokisa in 1700 mapped by Swanton (1911), highlighted on the map of Figure 4.10.

The following passages describing Han and Coaques culture and customs are all quoted from de Vaca's *Relación y Comentarios* of 1555 (Favata and Fernández 1993).

### Daily life and dress

> *We named this island the Isle of Misfortune. The people we found there are tall and well built. They have no weapons other than bows and arrows, which they use with great skill. . . .*

*All the people of this land go about naked. Only the women cover part of their bodies with a kind of wool that grows on the trees* [Spanish moss]. *Young women cover themselves with deerskins. These people share all that they have with one another. There is no chief among them, and all the people of one lineage live together. Two language groups live there: one group is called the Capoques and the other the Han. . . .*

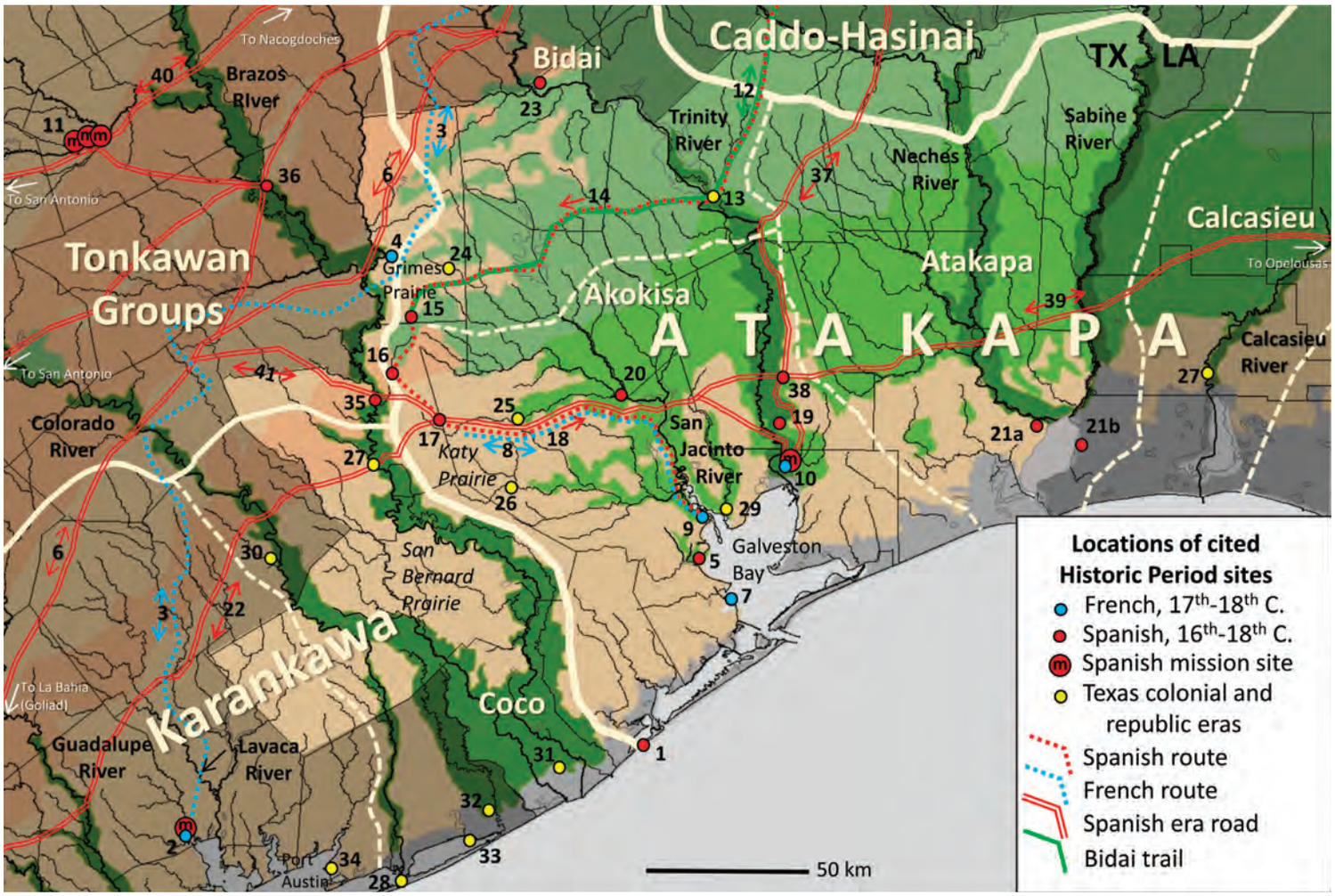
*The women do the hard work. They live on this island from October through February. They live on the roots that I mentioned* [submerged plant tubers, extracted with difficulty], *pulled from under water in November and December. They have cane weirs* [for fishing] *but there are no fish left by this season; from then on they eat the roots. At the end of February, they move on to other places to find sustenance, because at that time the roots are beginning to sprout and are not good. . . . Those who sought food found very little despite their great efforts because the weather was so bad. For this reason the Indians who were holding me* [the Han] *left the island and crossed to the mainland in canoes. They went to some bays where there are many oysters. They eat nothing else and drink very bad water for three months of the year.*

*Firewood is scarce for them, but mosquitos are plentiful. Their houses are made of mats and built on oyster shells, on which they sleep naked, putting animal hides on them if they happen to have any. We stayed there until the end of April, when we went to the seacoast and ate blackberries for the entire month, during which they hold their festivals with areítos and singing.* [Of June through September, de Vaca is silent.]

## Culture

*These people love their children more and treat them better than any other people on earth. When someone's child happens to die, the parents and relatives and the whole village weep for him for a full year. The parents begin crying each morning before dawn, and then the whole village joins in. They do the same thing at midday and at sunset. At the end of a year, they honor the dead child and wash themselves clean of the soot on their bodies. They mourn all their dead in this manner except old people, whom they ignore, saying that their time has passed and they are of little use, and that in fact they occupy space and consume food which could be given to the children. Their custom is to bury the dead, unless the dead man is a medicine man, in which case they burn the body, all dancing around the fire with much merriment. They grind the bones to a powder. A year later they honor the dead medicine man, scar themselves, and his relatives drink the powdered bones mixed with water.*

*Each one has a recognized wife. The medicine men have the greatest freedom, since they can have two or three wives, among whom there is great friendship and harmony. When someone gives his daughter in marriage, from the first day of the marriage onward, she takes all that her husband kills by hunting or fishing to her*




*father's lodge, without daring to take or eat any of it. The husband's in-laws then take food to him. All this time the father-in-law and the mother-in-law do not enter his lodge and he does not enter their lodge nor the lodges of his brothers-in-law. If they encounter him somewhere, they move away the distance of a crossbow shot, and while they are moving away, they lower their heads and keep their eyes on the ground, because they think it is a bad thing for them to see each other. The women are free to communicate and converse with their in-laws and relatives. This custom is observed on the island and for a distance of more than fifty leagues inland.*

## European disease transmitted

It was probably with de Vaca and his colleagues that the first European diseases were brought to the Texas coastal Indians, and half of the Native American groups that de Vaca first met soon died:

*The weather turned so cold and stormy that the Indians could no longer pull up roots and could catch nothing in the cane weirs they used for fishing. And since*

Figure 4.10. Known Native American encounters and European activities of the Spanish (red), French (blue), and post-colonial Texas era (yellow). Underlay consists of a map of landscape ecoregions, as described in Chapter 3. Spanish era roads (red double lines) are from Woodrick (2017). Beige lines delineate the inferred, approximate extent of Atakapa and Karankawa groups in the Early Historical period (modified from Swanton 1952), and beige dashed lines show approximate boundaries of bands within those two cultural groups.

1 Landing place of Cabeza de Vaca on Follett's Island, November 9, 1528
2 La Salle's landing, January 17, 1685, and the French settlement on Garcitas Creek
3 LaSalle-Joutel route to the Cenis villages, 1687 (route from Foster 1998)
4 La Salle assassinated, March 19, 1687
5 An abandoned Akokisa encampment visited by the Rivas-Iriarte expedition in April 1687
6 La Bahia Road, an old Indian trade route used by de Leon in his 1689 and 1690 expeditions, and later an important colonial era transit route to East Texas from New Spain (Mexico)
7 French castaway Simars de Bellisle lived with Akokisa in this area, west Galveston Bay, during the summer of 1719
8 Probable route of Bellisle on the Akokisa bison hunt of early winter, 1719
9 Jean Béranger and Bellisle meet Bellisle's former Akokisa masters at a camp here of 150 Akokisa; Béranger plans a site for a French fort
10 Site of French trader Joseph Blancpain's ill-fated trading post of 1744, later the site of the Spanish mission and presidio at Orcoquisac, founded in 1756
11 Site of Spanish missions of San Xavier (1746), Candelaria (1749), and Ildefonso (1749). All were abandoned by 1756.
12 Site of the Bidai Trail, which extended from Nacogdoches to the Trinity River, first travelled by Orobio Basterra in 1746. An extension reached the Grimes Prairie (Woodrick and Linton 2009, Woodrick 2017).
13 Approximate location of Bidais villages at a site that Orobio Basterra named Santa Rosa de Viterbo, on the Trinity River at the Bidai trail (Woodrick and Linton 2009 is the source for items 13-20).
14 Approximate cross-country route of Orobio Basterra in 1746 to the village of El Gordo at site 17 .
15 Approximate site of the village of Bidai Chief Tomás, 1745 and 1746.
16 Approximate site of the village of Akokisa Chief Mateo at upper Cypress Creek, 1745 and 1746.
17 The village of Akokisa Chief El Gordo, 1745 and 1746, and approximate location of the communal deer hunt of Jaranames, Karankawa, Coco, and Bidais Indians of September 1772 noted by Cazorla.
18 Orobio Basterra's approximate 1746 route from El Gordo's village (17) to the San Jacinto River , where he stopped at the reported location of a planned French fort (location 9).
19 Akokisan village of Calzones Colorado ("Red Breeches"), 1756.
20 Akokisan village of Chief Canos, 1756, as located by Bolton (1915) and Woodrick and Linton (2009).
21 Atakapan villages on either side of Sabine Lake, mapped by Miranda in 1756 and visited by Morfi in 1777. Several very large, uninhabited mounds noted by early settlers at the site on the Neches River on northwest side of Sabine Lake (21a; Block 1976, 1977) were later destroyed.
22 The La Bahia to Orcoquisac Road; also, the Atascosito Road (note: the Orcoquisac mission is at site 10, and Atascosita is at 38)
23 Village of Bidai Chief Tomás in 1772. It may be that the site where he was seen in 1746 and 1748 (Location 15) was merely his winter quarters, and that during the warm months they lived on the Trinity (Woodrick and Linton 2009).
24 The last Bidai site in Grimes and Montgomery counties, on Mary MacIntire's grant from Empresario Stephen F. Austin, 1831.
25 Nineteenth and early twentieth century Akokisa settlement on Burnett-Telge land, Cypress Creek, Harris County.
26 Early Nineteenth-Century Akokisa settlement and "Addicks" burial mound, upper Buffalo Bayou, Harris County
27 Stephen F. Austin's colonial capital at San Felipe de Austin
28 Site where merchants, including Nicholas Clopper Jr., were killed by Karankawa, 1822
29 Site of Cedar Bayou reciprocal massacres, Karankawa and settlers, ca. 1824
30 Battle of Skull Creek, 1824
31 Battle at Jones Creek, 1824
32 Site of Cavinagh and Flowers murders, 1826
33 Site of the Blessing Massacre, on the Colorado River near the town of Matagorda, 1826
34 Port Austin, where Alice Oliver learned the Karankawa tongue from a small group of surviving Karankawa in the early 1840s
35 Raccoon Bend, a shallow water crossing of the Brazos River used along the La Bahia to Orcoquisac Road, and a terminus for the Bidai Trail (later, the Coushatta Trace; see Woodrick 2017).
36 Site where Fr. Gaspar José de Solís encountered a mixed group of "Coco, Mayeye, Jojuane, Tancagueye, and many others" (evidently a communal hunting party) in 1768
37 Nacogdoches to Orcoquisac Road, built by the Spanish in 1756 to supply the Orcoquisac mission (location 10) from Nacogdoches
38 Atascosito town
39 Road to Opelousas, Louisiana (by 1829)
40 El Camino Real, connecting Coahuila with San Antonio de Bexar, Nacogdoches, and Natchitoches.
41 Orcoquisac Road, connecting the La Bahia Road (6) with the Spanish mission and presidio at Orcoquisac, near the mouth of the Trinity River (Woodrick 2020).

*their lodges offered so little shelter, people began to die. . . . At last, in a very short time, only fifteen* [Spanish] *survivors remained of the eighty who had arrived there from both directions. After these sixty-five had died, the Indians of that country came down with a stomach ailment that killed half of their people. They thought that we were the cause of their deaths, and were so sure of it that they plotted among themselves to kill those of us who had survived. When they were about to carry out their plan, an Indian who held me told them that they should not believe that we were causing them to die, because, if we had power over life and death, we would spare our own and not so many of us would have died helplessly. He told them that, since only a few of us remained and none of us was harming or hurting them, it would be best to leave us alone.*

On two occasions during their ordeal on Isla Malhado, hunger so overcame the Spaniards that survivors fed on the corpses of their companions. The Indians were reportedly very upset and shocked by this, and from this we learn that cannibalism engaged in by these Native American groups—there are several instances well documented by later visitors—was practiced only on their enemies and never upon family or friends (Weddle 1985).

### Mainland groups, trade networks and warfare

De Vaca describes how he left the Han and Capoques, who were treating him badly, and went to live for a few years with a people named the Charucco, who lived on the mainland across from Follett's Island, apparently between the Brazos River and West Galveston Bay in Brazoria County (Carson 2019b). This location would place the Charucco (of which name there are no other known historical references) in what would be, a century later, either Karankawan Coco or Atakapan Akokisa territory (Swanton 1911).

*I had to stay with these same Indians from the island for over a year. Because they worked me so hard and treated me so poorly, I decided to flee from them and go to those that live in the forests and mainland, a people called the Charruco. . . . [I] fared a bit better with them. I became a trader and tried to ply my trade the best I could. Because of this they fed me and treated me well, asking me to go from one place to another for things they needed, since people do not travel or trade much in that land because of the continuous warfare that goes on.*

*With my trading and wares I went as far inland as I wanted and I would travel the coast for a distance of forty or fifty leagues. The main items of my trade were pieces of sea snails and their insides, and seashells which they use to cut a certain fruit that looks like a bean, used by them for medicinal purposes and for dances and festivals (and this is the thing they value most), sea beads and other things. These are what I carried inland, and in exchange and barter I received hides and red ochre, which they rub on their faces and hair to dye them, flints for arrowheads, paste and stiff canes to make arrows, and some tassels made from deer hair, which they dye red.*

*I liked this trade, because it gave me the freedom to go wherever I wanted. I was*

> *obligated to nothing and was not a slave. Wherever I went they treated me well and fed me because I was a trader. Most of all I liked it because it gave me the opportunity to search for an escape route. I was well known among them and they rejoiced when they saw me bringing them things that they needed. Those who did not know me desired and strived to see me because of my reputation.*

The above passage is of special interest because it described the trade in lithic items from inland areas to the coast, where there were no natural lithic sources. Archeological data demonstrate that such trade in lithic materials went back millennia, as is discussed in some detail in Chapter 9. "Flints" would include chert from Colorado and Brazos cobbles found farther inland, where the rivers carry cobbles. Red ochre comes from outcrops of the Willis Formation, especially in Montgomery County, where it occurs as hematite nodules that would be ground with sandstone metates. Given that metates are not common on the coast, it could be presumed that the red ochre de Vaca traded was largely in pulverized form. Shell tools and ornaments are found in some inland archeological sites (Chapters 8 and 10).

De Vaca mentioned that he could travel extensively whereas the Charucco could not, owing to "continuous warfare." The red ochre sources were largely within Atakapa Akokisa territory (as defined by Swanton 1911), which suggests that the Charucco may have been the Karankawan Coco; their relationship with the Atakapan Akokisa would have been less close, although other historical references show that in later years they were friendly (see later discussion). Colorado and Brazos River cobbles used for chert ("flint") could come from inland parts of what might be considered Coco territory, but larger ones would be found still farther inland, west of Eagle Lake in areas inhabited by various Tonkawan groups. From the experience of Frenchman Simars de Bellisle on Galveston Bay in 1718, discussed later, coastal Akokisa could go far inland unmolested to hunt bison, but fiercely guarded their Katy Prairie hunting areas from "Toyals," probably a Tonkawan group from farther inland. These territorial disputes may be the source of the continual conflict that de Vaca mentions.

### Prairie fire and hunting techniques

Cabeza de Vaca was the first European to observe the use of prairie fire for hunting in the Texas coastal region. He wrote of his experiences in 1530 with the Iguaces Indians, who resided in present-day Refugio County just inland of Copano and San Antonio bays (Carson 2018, 2019b). De Vaca relates that the Iguaces would

> *go about with a firebrand, setting fire to the plains and timber so as to drive off the mosquitoes, and also to get lizards and similar things which they eat, to come out of the soil. In the same manner they kill deer, encircling them with fires, and they do it also to deprive the animals of pasture, compelling them to go for food where the Indians want.* (Stewart 2002:115)

## La Salle's colony and the accounts of Joutel and Talon

Nearly a century passed before the next documented encounter of Texas coastal people with Europeans. Frenchman René-Robert Cavelier, Sieur de La Salle, intended to found a settlement at the mouth of the Mississippi River. He headed

northwest from Cuba but overshot his target and landed instead at Lavaca Bay in early 1685 (Location 2, Figure 4.10). La Salle and his 180 colonists established a settlement on Garcitas Creek, north and slightly inland of the bay. Relationships with surrounding Karakawa Indians were friendly until La Salle's men stole two canoes from the tribe, which began a series of fierce retributions from members of the tribe. La Salle, completely lost, took two trips to try to establish his location before heading northeast on a third, in 1687, to try to reach his Illinois River outpost for help. That unhappy trip led to La Salle's assassination by his own men at a location near the Brazos River in Grimes County. La Salle's confidant and lieutenant, Henri Joutel, continued the expedition and reached Canada and France in 1688. Joutel's diary is a primary document telling the story of the lost colony and of the Native Americans they encountered.

Meanwhile, back at the settlement on Garcitas Creek, only about twenty survivors—many of them women, children, and the infirm—were left of an original 180-person colony. Within a few months of La Salle's departure, they were massacred by the Karankawa. Five children, including four named Talon and another named Bréman, were adopted by the Karankawa (a fifth Talon child, Pierre, had been left with the Cenis (Caddo) Indians by La Salle in order to learn the language, and so was spared the massacre).

La Salle's activities set up more than a century of jousting between the Spanish and French for mastery of the Texas-Louisiana frontier. The Talon children were eventually picked up in the dragnet the Spanish soon operated to root out the French incursion into their territory. Three Talon brothers later served on a Spanish warship that was captured by the French in 1696. The French then interrogated two of the Talon brothers, Pierre and Jean-Baptiste, in 1698. The document is full of useful anthropological information on the Karankawa. In particular, Jean-Baptiste resided with the Karankawas and remembered, years later, some of their language. Although the Karankawa that he lived with were not the same band as the Coco of the Southeast Texas project area, nonetheless their coastal lifestyles would have been similar.

The following quotations are from Joutel's diary (Foster 1998) and from a version of the Talon's interrogation published by Weddle (1987, hereafter abbreviated W).

### Daily life and dress

At Cavallo Pass on the tip of Matagorda Island, Joutel visited a Karankawa camp and observed details of their housing and daily life:

> *They were positioned on a point where they had about 50 huts, covered with reed or cane mats. A few huts were covered with dried bison hides. They were constructed with poles, bent like staves of a cask, and they looked like large ovens.* (Foster 1998:89)

This is a good description of the low, rounded temporary lodging used not only by the Karankawa but also by the neighboring Atakapa and even some groups of the interior Tonkawa (Figure 4.11). Joutel reported that such huts could lodge five or six individuals, and that they sometimes found abandoned camps where the poles

were left behind, but the mats and skins were taken with the mobile group (Foster 1998:89). Lacking the long straight lodgepole pine poles of their Plains Indian counterparts, who had tall, pointed tipis, the coastal tribes made do with yaupon and other saplings and a rounded, lower lodging.

Figure 4.11. Tonkawan shelter, Fort Griffin, 1870s. This type of rounded hut, made of bent saplings lashed together with a covering of cane mats or bison skins (or here, canvas) was used throughout the Texas coastal region. Photo courtesy of the DeGolyer Library, Southern Methodist University, Lawrence T. Jones III Texas Photographs.

On dress, Joutel noted: "We saw several women who were naked except for a skin that girded them and covered them to the knees. They had some marking on their faces and therefore were not very pretty. The men were all naked; several had deerskins that they slung across their backs as gypsies do." Joutel noted "that the Indians had a large number of canoes, as many as 40 of different kinds. La Salle also noticed that they had been constructed all-in-one piece, the same type of construction that he had seen on the [Mississippi] river he had come down" (Foster 1998:90). These were dug-out canoes, made by burning the insides to shape the wood, a practice shared by most southeastern tribes.

Jean-Baptiste Talon had been abducted by the Karankawa as a small child and thus had a different set of memories. Of the "Clamcoeh" (Karankawa), he noted their roaming lifestyle and round, temporary dwellings, echoing Joutel:

> *They inhabit the seashore, without any villages or fixed dwellings, continually roaming, living by hunting and fishing, and camping where night overtakes them in makeshift shelters erected then and there, with two forked branches and one cross-bar, which they cover with buffalo skins prepared for this purpose. With rushes they enclose this shelter, which is common with them and with the other nomad nations of the country, as well as those found from the seashore to the Cenis* [Caddo] *village.* (W:229)

In the nineteenth century, Anglo and Cajun settlers described the last few remaining, poverty-stricken Atakapans and Karankawans as "dirty," as discussed later. That was not the experience of young Talon with the Matagorda Bay Karankawa:

> *All these nations have the custom of going every morning at daybreak to throw themselves into the nearest river, almost never neglecting to do so, no matter what season, even when the water is frozen. In this case, they often make a hole in the ice and dive into it. They run with all their might, going to the river and also returning, and then they stand in front of a large fire prepared for the purpose. And they stand shaking their arms, their thighs, and their legs for awhile until they are thoroughly dry. Then, they wrap themselves in buffalo hides rubbed soft like chamois leather, which they use as robes, after which they walk about for some time. They claim that this gives them strength and renders them supple and fleet of foot. The men are very regular in observing this custom, without missing a single day when they are able. The women are not as constant in the practice. They all*

*swim like fish, the men as well as the women.* (W:230)

Few frontier Europeans of the time were as fastidious. A Native American wearing a soft and finely finished buffalo robe of the type mentioned by Jean-Baptiste Talon is shown in Figure 4.12.

Both Cabeza de Vaca and Henri Joutel mentioned face and body tatoos; Jean-Baptiste gives a detailed description of the process of receiving a tattoo, from first-hand experience; all the abducted children were tattooed by their Karankawan captors:

> [Their captors] *first tattooed them on their face, the hands, the arms, and in several other places on their bodies as they do on themselves, with several bizarre black marks, which they make with charcoal of walnut wood, crushed and soaked in water. Then they insert this mixture between the flesh and the skin, making incisions with strong, sharp thorns, which cause them to suffer great pain. Thus, the carbon mixes with the blood and oozes from these incisions and forms indelible marks and characters on the skin. These marks still show, despite a hundred remedies that the Spaniards applied to erase them.* (W:238)

## Culture

Music and dance were important. Talon noted: "They danced and sang, but very rudely, for their only instruments are a certain stick full of notches, which they scrape with another stick, and gourds, which they fill with small pebbles or grains of Indian corn." This description is similar to that given by Rebecca Burnett Lee of a mixed Bidai-Akokisa Atakapan group in western Harris County, on Cypress Creek, in the 1830s. That group was led by Chief Francisco (of whom more later), who played rhythmically on a stretched alligator hide over which a small stone was rubbed, giving a "honk-honk" sound (Moore 1995).

Drunkenness accompanied such celebrations. According to Talon, "they are given to drunkenness (because they make liquors that intoxicate almost like wine). . . . One of those liquors is made with a sort of red bean, which they chew and soak in water. It is their opinion that its use renders them more supple and fleet of foot. Therefore they drink it to such excess that they vomit several times, drinking and vomiting alternately almost without pause"

(W:231). This is a description of so-called "black drink" made from yaupon (*Ilex vomitoria*), once used extensively by southeastern tribes.

### Atakapan dress and tattoos

At about the same time, a small Mexican boy who had found himself a castaway on the southwest Louisiana coast was adopted by Atakapans living on the Calcasieu River. When repatriated during the visit of Enríque Barroto in 1687—Barroto was a pilot on the Rivas-Iriarte expedition searching for the French rumored to be in the region (discussed later)—nine-year-old Nicolás de Vargas was covered in tattoos:

> *Coming on board, he wept with joy at seeing himself among Spaniards. His face has tatoos like these Indians, with a black line that goes down the front to the end of his nose, another from the lower lip to the end of the chin, another small one next to each eye and, on each cheek, a small black spot. Like the nose, the lips are also blackened, and the arms are painted with other markings. His clothing consisted of the deerskin that girded the waist, and the hair has a circular cut like a religious lay brother's, with one line going down the neck to encircle the breasts like the other Indians of this nation.* (W:180).

The description of Atakapan haircut, dress, and facial tatoos that had been adopted by the Mexican boy closely resembles that of an Atakapan drawn by Alexandre DeBatz in New Orleans in 1735 (Figure 4.2), except for the black spots on the cheeks, which more closely resemble the facial tattoo pattern of the Coco (Figure 4.5).

### Warfare and cannibalism

The Talons entered into all the activities of the Karankawan tribe, including warfare:

> *They went to war with them [the Karankawa], who taught them how to shoot an arrow and how to run like them. These savages run so swiftly that there is no galloping horse, no matter how fast, that they cannot follow, and even leave behind. They [the Talons] went naked like them, and every morning at daybreak, in any season, they went to plunge in the nearest river. Like them, they ate meat from the hunt, fresh or cured in the sun, but most often raw. The only meals that horrified them were those they made of human flesh, as they [the Karankawa] are all cannibals, but toward their savage enemies only. They never ate a single Frenchman that they had killed because, they said, they do not eat them.* (W: 238)

This statement mirrors that of de Vaca, a century and a half earlier, who noted that the coastal people he was with were horrified that the Spaniards could be driven by starvation to eat their dead companions (as mentioned earlier). It is of interest, perhaps, to observe that medicinal cannibalism was widely practiced in Europe even into the nineteenth century. As a recent report in *Smithsonian Magazine* observed, powdered skull was a European treatment for epilepsy in respectable circles, human fat was rubbed on the skin as a cure for gout, and human blood was drunk because it was thought to contain the "vitality" of the body (Dolan 2012). Although

Figure 4.12. *Sauvage en habit d'hiver* (Savage in winter clothing); water-color by Alexandre DeBatz, drawn in New Orleans, 1735. The drawing is thought perhaps to be of an Atakapan (Bushnell 1927), primarily because of the man's resemblance to another DeBatz image, shown in Figure 4.2. The subject is wearing a finely prepared buffalo robe over a breechcloth. Courtesy the Peabody Museum of Archaeology and Ethnology, Harvard University, PM 41-72-10/21. Gift of the Estate of Belle J. Bushnell, 1941.

some regard Native American cannibalism as "primitive" behavior, it would seem no more so than European medical practice at the time.

Finally, Jean-Baptiste reflected on why, in his experience, the Karankawa developed into a group that was hostile to not only the French but arguably also to the Spaniards and Anglos who followed:

> *M. de la Salle would never have had war with the Clamcoëhs [Karankawas] if on arriving he had not high-handedly taken their canoes and refused them some little article of use that they asked him in return for them and for other services that they were ready to render to him. Nothing is easier than winning their friendship: a hatchet, a knife, a pair of scissors, a pin, a needle, a necklace or a bracelet or glass, wampum, or some other such trinkets being ordinarily the price, because they love passionately all sorts of knickknacks and baubles that are useful or ornamental. But also, as they give voluntarily of what they have, they do not like to be refused. And, while they are never aggressors, neither do they ever forget the pride of honor in their vengeance.* (Folmer 1940)

## Prairie fire and hunting

De Vaca's and Joutel's accounts on hunting techniques of coastal people are of special interest, because theirs are the only such accounts of coastal Texas Indians that predate the adoption of the horse by Native American groups. Coastal Texas groups obtained the horse sometime after about 1700, as the Spanish began to enter the country in search of La Salle. The Frenchman Simars de Bellisle reported that the coastal Akokisa had horses by 1718 (discussed later).

From de Vaca we learned earlier that the Iguaces used prairie fire to surround deer during a hunt. Henri Joutel lived for a time in the ill-fated colony at Matagorda Bay and then travelled through the area from Matagorda Bay to easternmost Texas in 1684–1687, and noted numerous examples of Indian burning of prairies both to hunt bison and deer and to encourage growth of new grass, which was done in his perception to *attract* buffalo for later hunting. In February 1685, while La Salle and Joutel were on the coast unloading a ship, "about 100 to 120 Indians came to our camp with their bows and arrows. . . . A little while later, the Indians, wishing to leave, made a sign to us to go with them on their hunt," an offer the French declined.

> *A few days later, we saw on the plains nearby a fire that spread and quickly burned the dry grass, drawing toward us. This compelled La Salle to have the grass around us quickly uprooted, particularly the grass around the gunpowder. . . . We noticed that the fire spread to the west-southwest and we decided that it had started near our first encampment and by the Indian village near that place.* . . .[Approaching the village, they startled an old woman, who ran away.] *Soon thereafter, we saw a canoe approaching with two women and a boy. They landed and when they saw that we had not harmed the woman, they came to embrace us in their special way, blowing against our ears. Then they made a sign that their people were on a hunt.* (Foster 1998:92, hereafter abbreviated F)

It is clear from that encounter that the Karankawans were hunting with the aid of prairie fire. It was a communal endeavor that took a large number of men, suggesting that large numbers were used either to act as beaters driving animals, or as

hunters killing driven animals, or both. A similar large hunt in the form of a game drive was noted near their settlement a few weeks later:

> *Some of our hunters saw some frightened deer running and concluded that Indians were chasing them. . . . Some time afterward, we saw some Indians gathered together on a point [on the bay, of whom three] approached us . . . and they told us by signs that their people were hunting nearby.* (F:100)

Native Americans sometimes drove deer in preferred directions, often to water (into the sea at peninsulas, or into creeks and rivers) where the animals could be slowed down and slaughtered (Hammett 1992). An earlier observation of this method came from John Smith in the Virginia Colony in 1624:

> *At their hunting in the deserts [prairies] they are commonly two or three hundred [Indians] all together. Having found the Deere, they environ themselves with many fires. . . . [They] drive them into some narrow point of land, when they find that advantage; and so force them into the river, where in their boats they have Ambuscadoes to kill them.* (John Smith 1624)

What Joutel saw at the point on Matagorda Bay would seem to be a similar occurrence.

Bison were very numerous around the coastal area near Matagorda Bay, and Joutel noted that in 1685 he once "found myself in the middle of 5,000 to 6,000 bison" (F:115). He noted that "the settlement was located about two leagues inland on the banks of a river which had been named *Aux Boeufs* [of Bison; this is modern Garcitas Creek]. . . . Toward the west and southwest there was prairie, very level. . . serving as pasturage to an infinite number of bison" (F:123). He continued, "It could be said that they were our daily bread" (F:126).

Joutel soon learned from the Indians that fire could be used to attract bison. "As the grass was dry, I had a fire set to burn it off in order to regenerate it. This caused the bison to wander off a little. But this was not for long, for when the grass began to grow, they were there almost every day" (F:139). Near modern LaGrange at Cummins Creek, in February 1687 he encountered Indians using fire to manage bison in this manner:

> *On the 10th we set off on our way. Having gone about a half league, we found burned fields and smoke all around us. This made us suppose that there were Indians in the vicinity. Consequently, La Salle, seeing that there were also bison in the area, decided it would be opportune to stop there and smoke some meat.*
>
> *. . . The natives have a particular knowledge of the country and the places the bison frequent. The bison were found in rather large numbers, which was surprising, in the midst of several bands of people who roamed in these areas. In addition, the grass had just been burned and almost none had appeared. But these animals seem to delight in searching for the small sprigs of grass just beginning to sprout. We stayed there for two days; during that time we killed several bison which we smoked for our provisions.* (F:174)

Upon crossing the Colorado River near La Grange, Joutel again experi-

enced Indians using fire in Indian game management and hunting: "Bison were not abundant in this area; the natives who had set fire to the grass had scattered them. . . . Indians had hunted there for some time. . . . The scenery was very agreeable: mottes of trees from place to place, and, in locations where the grass had been burned some time ago, it was beginning to green and looked like the wheat fields of France during April" (F:176). The Indians pointed out to Joutel that the Native American groups along the Colorado River hunted by driving bison herds back and forth between the tribes (F:190).

### Other hunting accounts of the era from the Mississippi River valley

Communal hunts by Native Americans using fire to drive bison were observed by the French in the Mississippi River valley to the east during the same period. A French visitor of 1758 named Charlevoix observed the practice of using fire in large game drives to hunt bison along the Mississippi River in Louisiana:

> *In the Southern and Western Parts of New France, on both sides of the Mississippi, the most famous hunt is that of the Buffaloe, which is performed in this manner. The Hunters range themselves on four Lines, which form a great Square, and begin by setting Fire to the Grass and Herbs, which are dry and very high: Then as the Fire gets forwards, they advance, closing their lines: the Buffaloes, which are extremely afraid of Fire, keep flying from it, and at last find themselves so crowded together that they are generally everyone killed. They say that a Party seldom returns from hunting without killing Fifteen Hundred or Two Thousand. But lest the different Companies should hinder each other they all agree before they set out about the Place where they intend to hunt.* (Charlevoix's Letters, 1763, R. Goadsby English edition, as quoted in Stewart 2002:115)

A cooperative bison hunt involving a large number of Native Americans was noted by the early French trader Nicholas Perrot in Iowa in the late 1600s and evokes a detailed image of hunting by Indians before the arrival of the horse:

> *When the village has a large number of young men able to bear arms they divide these into three bodies; one takes its route to the right, another that to the left, and half of the third party is divided between the two former ones. One of these latter parties goes away* [from its main column] *a league or thereabout to the right, and the other remains on the left, both parties forming, each on its own side, a long file; then they set out, in single file, and continue their march until they judge that their line of men is sufficiently long for them to advance into the depths [of the forest]. As they begin their march at midnight, one of the parties waits until dawn, while the others pursue their way; and after they have marched a league or more another party waits again for daylight; the rest march [until] after another half-league has been covered, and likewise wait. When the day has at last begun, this third party which had separated to the right and the left with the two others pushes its way farther; and as soon as the rising sun has dried off the dew on the ground, the parties on the right and the left, being in sight of each other, come together in [one] file, and close up the end of the circuit which they*

*intend to surround.*

> *They commence at once by setting fire to the dried herbage which is abundant in those prairies; those who occupy the flanks do the same; and at that moment the entire village breaks camp, with all the old men and young boys who divide themselves equally on both sides, move away to a distance, and keep the hunting parties in sight so that they can act with the latter, so that the fires can be lighted on all four sides at once and gradually communicate the flames from one to another. That produces the same effect to the sight as four ranks of palisades, in which the buffaloes are enclosed. When the savages see that the animals are trying to get outside of it, in order to escape the fires which surround them on all sides (and this is the one thing in the world which they most fear), they run at them and compel them to reenter the enclosure; and they avail themselves of this method to kill all the beasts. It is asserted that there are some villages which have secured as many as fifteen hundred buffaloes, and others more or fewer, according to the number of men in each and the size of the enclosure which they make in their hunting.* (Wissler 1920)

This method of hunting by surrounding bison with fire is similar is similar to the deer hunting technique of the Iguaces observed by de Vaca.

## The Spanish and the French joust for East and Southeast Texas

The Spanish response to the French incursion into their territory by La Salle was immediate. Hearing about the French from captured pirates, in 1686 the Viceroy of New Spain sent two explorers, Martín de Rivas and Pedro de Iriarte, to find the French interlopers. They used small ships that enabled them to search small bays from Florida westward, and as a consequence were the first to inspect closely not only the mouth of the Mississippi, but also Galveston and Atchafalaya bays and the Sabine estuary, which brought them into Atakapa territory. In Galveston Bay on April 25, 1687, the aforementioned Enríque Barroto (a pilot on the voyage) recorded that an Indian guide took them from what appears to be modern Eagle Point (in San Leon) to an abandoned campsite two leagues to the northwest (location 5 on Figure 4.10, probably near modern day Seabrook:

> *The canoe went two leagues northwest of this point to a river by which they went to the ranchos* [Indian village]. *They found that they* [the Indians] *had forsaken them a great while ago, since there were no fresh signs but only sticks and arches still arranged in the shape of their bujíos [huts].* (W:186)

They were experiencing something that the French had seen, the frames of abandoned round-shaped huts. The San Jacinto River estuary, as we learn from de Bellisle's account to follow, was the home of a group of coastal Akokisa. Akokisa people, like the Karankawa, were mobile, and their hide-covered homes were only temporary shelters, easily erected and easily moved.

The Spanish mariners ultimately found the wreckage of La Salle's flagship, *Belle*, in Matagorda Bay. They described the local Karankawa there as impressive of stature, inclined to be hostile, and terrified of firearms (Weddle 1987).

From land, Governor of Coahuila Alonso de León travelled in search of the French settlement and found it in 1689. Returning to that site in 1690, he burned the buildings and then took some Franciscan priests to East Texas to preach to the Tejas (Hasinai Caddo) Indians, using an old Indian trade route (Foster 1995). They founded in that year the first of several Spanish missions in Texas, on San Pedro Creek in eastern Houston County, north of the study area boundary of Figure 4.10. De León's route to the Hasinai later became known as the La Bahia road, and was used by many successive Spanish visitors (Location 6, Figure 4.10). However, neither de León nor a successor a year later, Domingo Terán de los Ríos, ventured into Southeast Texas.

Meanwhile, French explorers and settlers began to arrive in the Mississippi Valley to follow up on La Salle's successful trip down the Mississippi River in 1682, where Louisiana had been claimed for France. The first settlement was at Fort Maurepas (near Ocean Springs, Mississippi) in 1699. In 1713–1714, the settlement at Natchitoches, on the Red River, was founded by Louis Juchereau de Saint-Denis, in part to keep the Spanish from venturing into French Louisiana, but perhaps more importantly, in order to foster trade with the Spanish. In pursuit of that task, St. Denis travelled overland from Natchitoches to San Juan Bautista (modern Villahermosa, Mexico) twice, in 1713–1714 and in 1716, but his route was inland from the project study area. Nonetheless, it resulted in part in a foundational map of the region, published by Guillaume de L'Isle in Paris in 1718 (Figure 4.13). On that map, the first to plot the course of the Mississippi River accurately, La Salle's landing place at Matagorda Bay is featured along with the lower Mississippi, but Galveston Bay and the rest of the intervening coastal area of Southeast Texas and southwestern Louisiana is poorly charted *terra incognita*, considered by the French as a harsh land of *Indiens errans et Anthropophages* (wandering Indians and cannibals). St. Denis had first-hand knowledge of the Karankawa, and no doubt had heard less than flattering things about the Atakapa from the Caddos and other rival groups on the northern rim of the Atakapan lands. The moniker stuck, and for a century this part of the northern Gulf of Mexico was called the "Cannibal Coast" (Weddle 1987). Europeans were fascinated with and horrified by the taboo of cannibalism. They received another set of stories relating to this taboo with the Atakapa from a different French traveller.

Figure 4.13. A part of the *Carte de la Louisiane et du cours du Mississippi*, by Guillaume de L'Isle, published in Paris, 1718. Matagorda Bay (*Baye Saint Louis ou Bernard*), where La Salle landed, and the Mississippi Riv-er are both featured, but Galveston Bay and the rest of the intervening coastal area at this time were still largely unknown, and considered by the French as a harsh land of *Indiens errans et Anthropophages* (wandering Indians and cannibals). St. Denis' routes of 1713–1714 and 1716 to Villahermosa, Mexico, are shown on the western edge of the map, as are Bidais villages on the Trinity River and a village at the mouth of the Trinity with the puzzling label of *Judosa* ("Jewish" in Spanish). Courtesy of the Library of Congress.

### Simars De Bellisle's account

Simars de Bellisle shipped from France to the new Louisiana colony in 1719, but the inept captain of his ship overshot the Mississippi, much as La Salle had done, and ended up stuck in the mud near the mouth of Galveston Bay. Bellisle and three other ship's officers were put ashore—ostensibly to walk home to Louisiana for help—and were ashore when the ship was freed and sailed away without them (Weddle 1991). After his companions died of starvation, de Bellisle rowed his dugout canoe into Galveston Bay and approached some Atakapan Akokisa Indians who had been collecting eggs on an island; they promptly enslaved him for the following year and a half, thereby enabling his survival. He was the first European since de Vaca to have extensive contact with coastal Akokisa, and his accounts, retold by Folmer (1940),

give a good description of the lifeways of the people who lived along Galveston Bay and the San Jacinto estuary.

The Akokisa, with Bellisle in tow, wandered on the mainland in the summer months, digging up roots and eating the occasional deer or bison along the west side of Galveston Bay; the lifestyle described was very similar to that of the Karankawa as described by Jean-Baptiste Talon at Matagorda Bay:

> *I passed the entire summer in this country with them in going everywhere in search of food because they possess no cabins or fields. That is why they travel in this manner the entire summer. The men kill a few deer and a few buffaloes and the women search for wild potatoes [tubers]. They do this when the weather is fine. When it rains no one goes out to look for food, and they pass easily two or three days in this manner without food, drinking only water and throwing it up without any effort. They told me to do the same and that this was good.* (Folmer 1940)

When winter came, the Akokisa group left the area—probably the west side of Galveston Bay—to join another Indian group "at the head of the bay" (probably the San Jacinto estuary) to travel inland for a communal bison hunt: "After a few days had passed, they told me that all the men were going to hunt buffaloes and we were going to war against their enemies, and that I should keep myself ready to go with them the next day and that I should carry part of their baggage on my back." He describes the hunt as starting with a forced march of three days to get

to the hunting area on the open prairie; he had to keep up with the Indians on horseback: "We left then and they go very fast because they have good horses, and I had to keep up, naked as I was . . . I walked for two days under such condition, and the third day we arrived at a prairie that seemed endless in every direction and where numerous buffaloes were grazing" (Folmer 1940:219). Based upon archeological data presented in Chapter 8, the nearest of the traditional bison hunting grounds to the mouth of the San Jacinto would be along the headwaters of upper Buffalo Bayou at the edge of the Katy Prairie (Location 8, Figure 4.10), making de Bellisle the first European to cross what would 150 years later become Harris County, and the first European we know of to enter the hunting grounds of the Katy Prairie, which as described in Chapter 8 had been a bison hunting ground from the Early Paleoindian Period until Bellisle's time.

The group had four horses. The Akokisa were not the first in the region to have horses; Weddle (1991) relates that the Caddo had horses as early as 1691. The horses allowed a few key participants to hunt on horseback with bows and arrows. It would appear that this method gave better results than earlier methods of surrounding the animals or of chasing bison into creeks, as described earlier. While hunting they saw the smoke of another hunting group, their enemies the "Toyal," who were apparently using prairie fire to hunt. The Akokisa gave chase to the Toyals, killing and, to Bellisle's horror, skinning and eating one of them, a scene Bellisle later described in detail. The Toyal were likely one of the Tonkawan groups living outside and west of the San Jacinto drainage basin—the Akokisa's core territory—and had wandered in, perhaps to take advantage of the wooded creeks where coastal peoples had been butchering bison and deer for millennia.

De Bellisle, regularly beaten and mistreated by the Akokisa, managed to send a letter via his Indian captors "to the first white man" and was eventually rescued by a group of Hasinai Indians on horseback, sent by the French in Louisiana. He found his way back into Louisiana by 1721. His account of the buffalo hunt is of prime importance in showing that the coastal Akokisa people—living on the coastal lands in the warm months—migrated inland in the early winter to hunt in the tallgrass prairie. Of particular interest in popular accounts was the incident with the unfortunate Toyal; the French artist depicting De Bellisle's rescue by the Hasinais could not help himself from salaciously throwing in some severed arms in the foreground of the illustration, as a pure fabrication (Figure 4.14).

This migratory, communal hunting of bison was also noted among Atakapan people living farther east, in southwest Louisiana. In 1781 Louis LeClerc Milfort came upon a Frenchman named Joseph who had lived for years among the Atakapa in southwest Louisiana. He described their annual hunting that occurred late in the year:

> *We are in the habit of dividing ourselves into two or three groups in order to fol-*

Figure 4.14. The rescue of Simars de Bellisle from the Akokisa, from Jean Bernard Bossu's *Nouveaux Voyages dans l'Amérique septentrionale* (1777). This fanciful illustration, drawn for popular consumption, shows Bellisle, wearing a shirt sent to him by St. Denis in Louisiana, preparing to ride away with his Hasinai Caddo rescuers. An Indian woman lovingly tries to induce him to stay, which is about as realistic as the two severed arms in the foreground—a reference to cannibalism for Paris readers. The artist was G. de Saint Aubin. From Folmer 1940.

> *low the buffalo, which in the spring go back into the west, and in autumn come down into these parts; there are herds of these buffalo, which go sometimes as far as the Missouri; we kill them with arrows; our young hunters are very skillful at this hunting.* (Milfort 1802)

The bison of which he spoke probably entered the Mississippi Valley in autumn, migrating south for some distance as weather turned cold and inland prairie grasses froze.

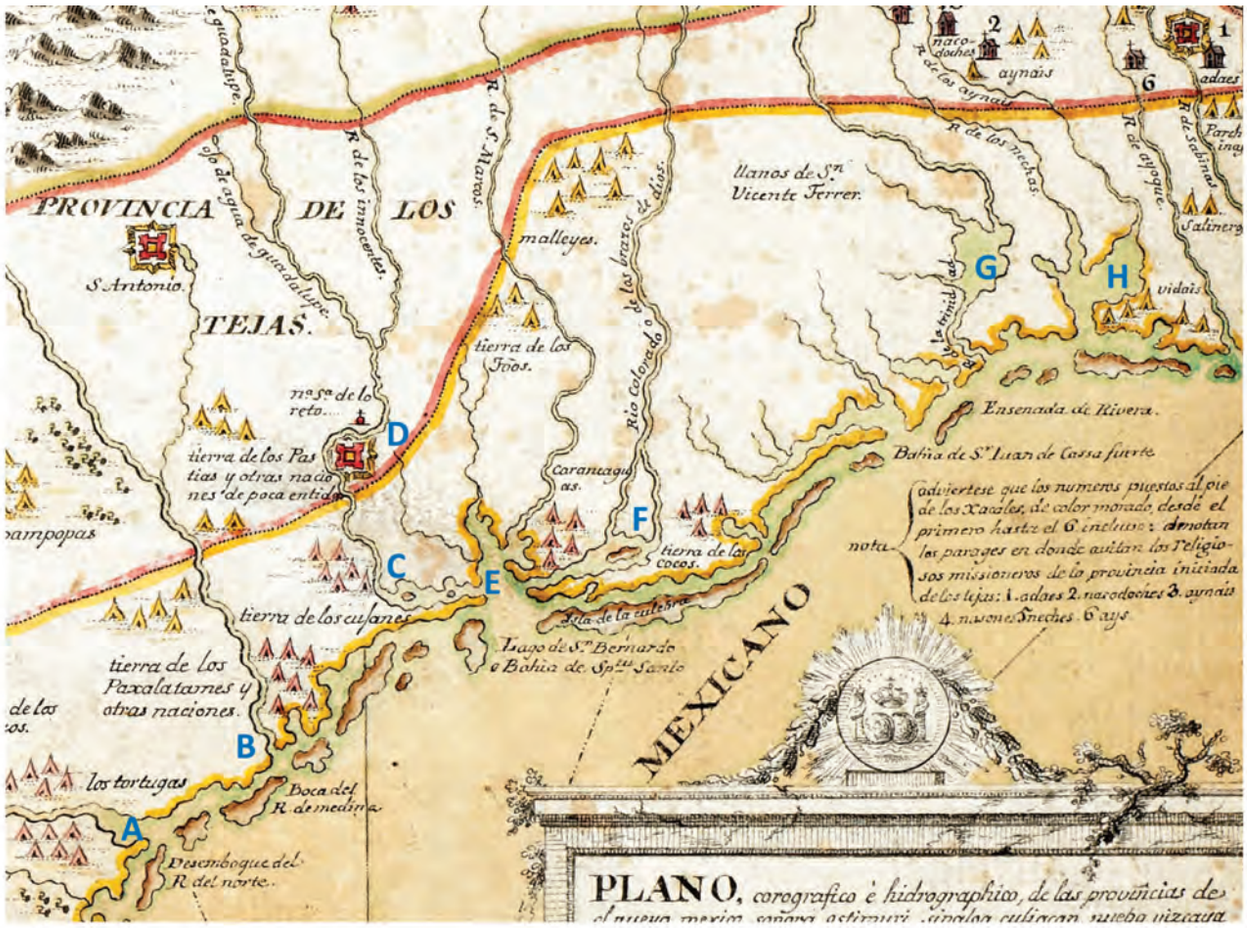
## Jean Béranger on Karankawan boatbuilding

In 1720, while Bellisle endured the aftermath of his trip to Galveston Bay, fellow Frenchman Jean Béranger left Louisiana to reestablish La Salle's claim on Bay Saint-Bernard (Matagorda Bay). Landing at Copano Bay, which he mistook for Bay Saint-Bernard, he observed at nearby San José Island the Karakawan method of boatbuilding: they placed burning coals on a log and scraped away charred wood with bone knives (Wagner 1967, cited in Weddle 1991).

In 1721, Béranger and the newly returned Bellisle sailed under Jean-Baptiste Bénard, Sieur de La Harpe, to reclaim Bay Saint-Bernard (Matagorda Bay) and La Salle's legacy, by force if necessary. Reaching Galveston Bay in August 1721, they mistook it for Matagorda Bay. Exploring Trinity Bay, La Harpe and Bellisle found Bellisle's former captors, whom Bellisle recognized and who were "much surprised." They moved to the mouth of the San Jacinto river to find a suitable spot for a post (Location 9, Figure 4.10). Here they found Akokisa in dugout canoes, who owned horses. At a campsite near there, they met with 150 Indians, who reportedly wondered whether they should kill the Frenchmen, fearing retribution for their mistreatment of Bellisle. Moving on, the Frenchmen found the mouth of the Trinity River, and then returned by sea to Louisiana without ever having seen Bay Saint-Bernard. However, they brought some Akokisa hostages, from whom they compiled an Akokisa word list (Weddle 1991).

## The Spanish move into Southeast Texas

The government of New Spain was well aware of these further French incursions into Texas and sent a number of *entradas* (entries) into the region. As mentioned, Governor Alonso de Léon was the first to venture beyond the Nueces River, in search of La Salle's settlement, in 1689. He found the ruins of the fort. A number of other expeditions followed, founding various missions in efforts to solidify the Spanish claim on the country as well as to cultivate the loyalty of Native American population. Of particular note for the study of indigenous coastal inhabitants is the expedition of Brigadier Pedro de Rivera in 1727. Rivera's was an inspection tour of the presidios of the region, which by that time included Presidio La Bahía on the Guadalupe River, southwest of the modern town of Goliad, where the presidio and mission were eventually moved in 1749 (Foster 1995). Rivera brought a military cartographer with him, Francisco Álvarez Barreiro, who explored Matagorda bay and the surrounding coast, leaving a record of the dwelling locations of various Karankawan bands, including the Cujanes, Carancaguesas, and the Coco (Figure




4.15).

Béranger was not the last Frenchman to arrive in Atakapa country of Southeast Texas. French fur traders came from the Mississippi Valley, trading rifles, powder, and shot to the Atakapans for deer and buffalo hides, bear grease, horses, and mules; most of the latter animals were being regularly stolen from Spaniards. In 1738 Frenchman Joseph Blancpain formed a partnership to trade with the Atakapans, and by 1744 he was trading on the lower Trinity River. When word of this trespass onto Spanish Texas soil reached the Spaniards, several expeditions resulted, the details of which are well described by Weddle (1991) and Bolton (1970 [1915]), from whose accounts much of the following summary is taken.

## San Xavier missions founded for coastal tribes

Spaniards heard of Blancpain and immediately sought to remove the threat, realizing that they would otherwise have to compete with the French for the allegiance of the various Native American groups. Franciscan priests had been regularly visiting the area as early as 1734, and in 1745 Franciscan Fray Mariano Francisco de los Dolores y Viana, stationed at Mission Valero in San Antonio, travelled with Texas Governor Wintuisen to the Trinity River, trying to induce several groups, including the Deadose—an Atakapan group of whom little is known—to join the San Antonio mission. They did not succeed; San Antonio was too far for these groups to contemplate resettling there. In 1745 Franciscan friars founded three missions along

Figure 4.15. A portion of a map of New Spain, including the Province of Texas, surveyed by Francisco Álvarez Barreiro *(Plano Corografico é Hydrographico de las Provincias de el Nuevo Mexico . . . Provincia de los Tejas . . . de la Nuebla España).* Orig-inally drawn in 1728, it was copied in 1770. Courtesy of the British Library, Cartographic Items, MS. 17,650.b. Added locations (in blue):

A. *Rio del Norte* (Rio Grande River).
B. Mouth of the Medina (San Antonio) River.
C. Mouth of the Guadalupe River at modern San Antonio Bay, with Karankawan *Cujanes* villages.
D. Presidio at La Bahía, then located on the Guadalupe River.
E. L*ago de San Bernardo* (Matagorda Bay), with a village of *Caran-caguas* (Karankawa band proper).
F. Mouth of the *Rio Colorado o de las brazos de díos* (Colorado or Brazos River; the cartographer was uncertain which). Just to the east is a Coco village.

G and H hint at the locationsof

Galveston Bay and Sabine Lake, respectively, but the region was not studied extensively
by Barreiro and that part of the map is rife with errors.

the San Xavier (now San Gabriel) River to the northwest of Akokisa territory (Location 11, Figure 4.10) in order to induce coastal tribes (Akokisa, Bidai, Deadose, Coco) as well as interior groups like the Mayeye, Yojuane, and Hierbipiames into a Spanish rather than a French orbit. These missions were San Xavier (founded 1746), Candelaria (1749), and San Ildefonso (1749). The effort was plagued from the start by Spanish bureaucratic infighting, mistreatment of Indians by soldiers, intransigence and indifference of the Indians, and attacks by Lipan Apaches. The effort was a failure and was abandoned by 1756.

From the accounts of the failed effort, however, we learn that the Bidai, Deadose, and Akokisa—all Atakapans—preferred to camp together rather than with the interior groups, which eventually resulted in the founding of the San Ildefonso mission to accommodate them separately. They were observed to be closely intermarried and spoke the same language (Bolton 1970 [1915]:197). At the mission's start, there were 59 Akokisa, 88 Bidai, and 55 Deadose. Hunters from these groups were frequently offsite, looking for buffalo to augment their meagre mission diet.

The Coco, who apparently did not favor a mission at La Bahia (modern Goliad) founded by that time for the Karankawa, were not happy with the San Xavier mission either and soon left for their lower Brazos home, where they contracted smallpox. A Franciscan friar brought the survivors back, and built a third mission in 1749, Candelaria, for them. From this we can infer that the Coco were a people somewhat removed from the rest of the Karankawa, but not close enough to the Atakapa to wish to live with them. Archeological evidence presented in Chapter 8 shows a mix of Late Prehistoric Atakapan and Karankawan pottery styles at their interior hunting camps in Wharton County, supporting the idea that the group lived in a narrow niche between the two cultures.

## Mission epidemics

By 1749 the Atakapans at San Ildefonso mission had deserted, complaining of mistreatment by the soldiers, but most eventually returned. In about May of 1750, however, a smallpox epidemic hit the mission, and a great many died in horrible circumstances. In July an official delegation arrived at the San Xavier missions, including San Ildefonso, to make a survey and census. It was a time of upheaval, as the missions were just recovering from the epidemic and food supplies were scarce. Here at some length is an account from that visit:

> *A persistent request was made by the Commissioner Judge to see the entries in the Book of Baptisms, of which there were in all two hundred and fifty-three, being the majority of them adults that died in the smallpox epidemic which aggravated the shortage of food that the Ministers were* [then] *experiencing, since they barely had for themselves some jerky and tortillas. This [shortage of food] had forced the Indians to disperse into the countryside [to search for food]. Almost all of the* [Indians of the] *Mission of San Ildefonso had been staying about two leagues distant from the mission, and there the contagion assailed them with such rigor that they could not take a step, and that made it extremely difficult for the missionaries to catechize them and bring them some food. The Lord strengthened them to administer the Sacraments to them in so fatal and corrosive an epidemic that not only*

*disfigured them* [the Indians] *like monsters, but they* [the supporting missionaries] *also used to take the bodies of the deceased from the jacales* [huts] *fallen into pieces. But his Majesty* [the Lord] *gave them the consolation that none died helpless or without holy Baptism, and more importantly that a harvest [of baptisms] was achieved with the small children, the number of which reached forty deaths.*

*The Indians all returned to the Mission, and many of them with gangrene sores, of which they were dying. Among them was one instructed in their superstitions of the Texas [*Tejas Indians]*, who had as priest of those infamous rites, and as zahorí [a water diviner or dowser] told them the times for hunting and other things and falsehoods, so that even the soldiers called him "the priest." He was catechized and baptized while in his danger* [of dying]*, and everything was ulcerated and so melancholic that in the whole day the Fathers did not leave his side. He was admired by all, because since he was baptized he lost all his skills and divining crafts, and the Indians no longer looked at him as before. He himself said that his heart did not rest if he wasn't with the Fathers, to whom he was in debt. He died while being helped by them. After these ravages the Indians returned to the Mission, and with them the census was made; that is already said.* (Arricivita 1792:328–329)

The census takers counted 165 Native Americans at San Ildefonso (plus another 11 still absent), showing how great a percentage of the tribe had been taken by that one epidemic. They were a mixture of Atakapans, including 65 Bidai, 10 Patiri, and 32 Akokisa and Deadose (Bolton 1970 [1915]:231).

The founding of the missions during the great dying of coastal people in the eighteenth century was no coincidence. As European diseases ripped through these groups due to the increased contact with Spanish and French colonialists in the region, Native American groups were weakened, and that weakness in turn was a prime motivator for them to join the missions. Gathered at the missions, they became yet more susceptible to the introduction of yet more epidemics. Baptismal records show that most of the missions' baptisms occurred on the deathbed. The San Xavier mission efforts were a failure, and they were all abandoned by 1755, when a fireball was seen in the sky over the area (Bolton 1970 [1915]:268).

## Joaquín de Orobio Basterra observes winter villages on the Katy Prairie

Meanwhile, it was becoming obvious to the Spanish that a mission for the Akokisa and Bidai was needed in their coastal home country in Southeast Texas, in order to counteract or otherwise shut down the entry into the area by French traders, in-

cluding Blancpain. In February 1746 Captain Joaquín de Orobio Basterra of the La Bahía presidio travelled to the Lower Trinity River to check on rumored French border encroachment. Traveling with a Bidai guide from Spanish Nacogdoches along what became known as the "Bidai Trail" (Location 12, Figure 4.10), he reached a Bidai village on the Trinity River (Location 13). The Bidai were reportedly living in "bearskin tents" in their normal winter quarters. They had never before seen Spaniards. Using a Bidai guide, he crossed the Trinity and headed thirty leagues west-southwest along an extension of the Bidai trail (Location 14), ultimately reaching the winter village of an Akokisa chief that the Spaniards named El Gordo, at a site he called Puesto San Rafael (Location 17; Bolton 1970 [1915]:330). Reportedly, the Bidai village of a chief named Tomás was nearby; later testimony of Sergeant Domingo del Río, who visited the area in 1755, places the Bidai camp seven leagues (about 25 miles) north of El Gordo, at the headwaters of Spring Creek (location 15). A third village, of an Akokisa chief named El Mateo, was in between the two (approximately positioned as Location 16; Woodrick and Linton 2009).

Figure 4.16. Native Americans suffering from the smallpox epidemic of 1520, Mexico. The epidemics that raged through coastal Texas Native American populations two centuries later had similar horrific effects. The drawing is from the Florentine Codex (1540–1585), Book XII, folio 54, Biblioteca Medicea Laurenziana, Florence.

Some comments on the locations in this vicinity that are shown on Figure 4.10 are in order. The location of El Gordo's village was placed by Bolton (1970 [1915]) as on Spring Creek. Recently, historian James Woodrick (Woodrick and Linton 2009) reviewed Spanish documents from the time, especially those relating to the visit of Bernardo de Miranda, who visited the site in 1756. These make it clear that the site was at the headwaters of Cypress Creek, south of Hoskins Mound, where modern Snake Creek and Mound Creek join near some springs (location 17). Miranda named the place Santa Rosa del Alcázar, and proposed to place a mission there, with a presidio placed on a nearby high spot that Woodrick and Linton believe is Hoskins Mound. This site makes sense from the perspective of landscape and archeological data that show abundant hunting sites all along Cypress Creek and very few such sites along Spring Creek (see Chapter 8). The location of Orobio's route from the Trinity River to El Gordo's village (Location 14) is not specified in detail in Spanish documents, but is here suggested to have followed a set of small open meadows depicted on the U.S. Geological Survey's 1:250,000 scale topographic map, the Beaumont sheet of 1954, which had been drawn before several manmade lakes altered the area. This would have taken them through Grimes Prairie, an indentation in the western edge of the Pineywoods forest where some of the last Bidai Indians were known to live in the early nineteenth century (Location 24**,** discussed later). It seems safe to assume that Bidai chief Tomás's village would face Grimes Prairie, and that location fits Del Río's 1755 notes that place El Gordo's village "distant seven leagues [about 25 miles] from the place he [Tomás] is presiding at the commodious rancheria" (Del Río, as quoted by Woodrick and Linton 2009).

The significance of these locations is that Akoksia chiefs Mateo and El Gordo were wintering in the Katy Prairie, near where Bellisle had participated in a winter communal hunt with the coastal Akokisa a few decades earlier, and where Native Americans had been hunting deer and buffalo for millennia (Chapter 8). Orobio was not the last Spaniard or Frenchman to observe communal hunting in the Katy Prairie, as we shall see.

While visiting with the Bidai and Akokisa on this trip, Orobio Basterra heard plenty about French encroachments in the region. Some Frenchmen had come over-

land into East Texas, but others had come by sea, going up the various rivers, but still with no settlement. These were traders, looking primarily for buffalo, deer, and bear skins. The previous summer, Orobio was told, these French traders told the Bidai, Deadose, and Tejas (Caddo) by way of Akokisa messengers that they should bring their skins to what appears to have been the mouth of the San Jacinto, where Béranger had earlier planned a fort (Bolton 1970 [1915]:331). Orobio Basterra then travelled to that site; his probable route is labelled as location 18, with Béranger's fort location at the end of that route, location 9. Finding nothing, and not impressed with that site as a future mission site, he returned to Nacogdoches and to La Bahía. He recommended that a mission be placed among the Akokisa.

Figure 4.17. A portion of Miranda's map of 1757, courtesy the University of North Carolina map files. The red outline shows, approximately, the area shown in Figure 4.10. Site numbers corre-spond to those of Figure 4.10:

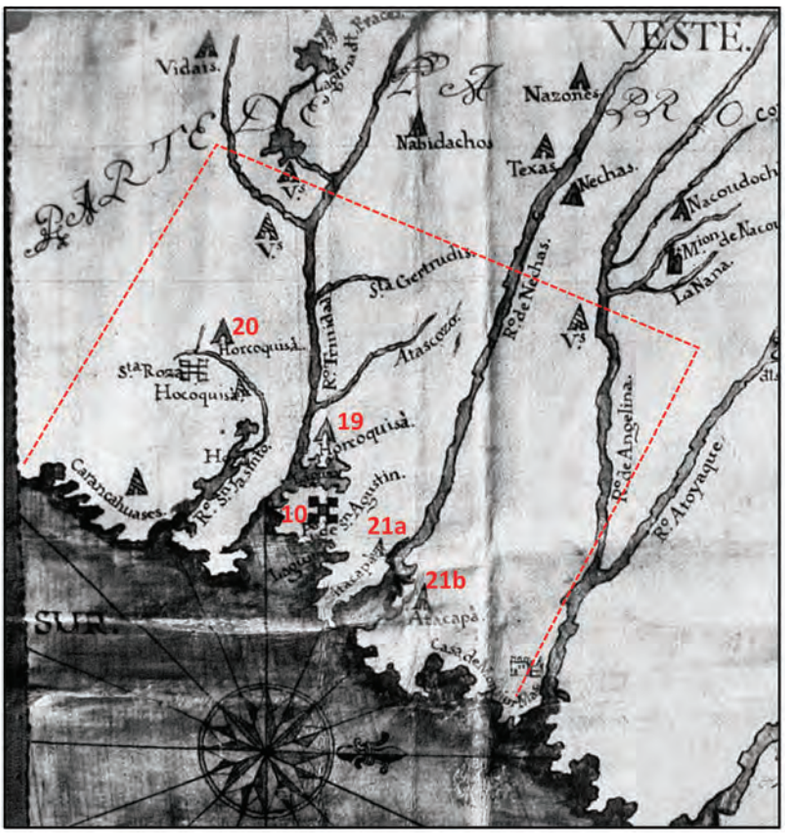
10. Orcoquisac Mission and Presidio
17. Akokisa village, Chief El Gordo, and Santa Rosa del Alcazar
19. Akokisa village, Calzones Colorado
20. Akokisa village, Chief Canos
21. Atakapa sites on either side of Sabine Lake

### El Orcoquisac mission and presidio

The French trader Blancpain, meanwhile, had opened up a trading post on the Lower Trinity by 1744 (Location 10, Figure 4.10); Orobio had searched the wrong river. The post was not far downstream from the Akokisa village of Chief Calzones Colorado ("Red Breeches"). The village site has recently been located from Spanish era documents by Woodrick and Linton (Location 19). The newly appointed Spanish governor of Texas, Jacinto de Barrios, heard about the illicit trading post and sent Lieutenant Marcos Ruiz in 1754 to arrest Blancpain. Ruiz went to the villages of Tomás, El Mateo, and El Gordo to enlist their support by giving them trade items, and then descended the Trinity River with them, surprising and arresting Blancpain in October 1754 (Woodrick and Linton 2009; Bolton 1970 [1915]). After demolishing Blancpain's trading post, the Spanish then erected the Presidio de San Agustín de Ahumada and the mission Nuestra Señora de la Luz de la Orcoquisac, otherwise known as the Orcoquisac mission, in 1756 (Location 10); Ruiz was placed in charge of the garrison. *Orcoquisac* is the Spanish term for Akokisa.

Governor de Barrios visited the new mission site of El Orcoquisac in late 1756, and heard from his Captain Del Río of a site on Spring Creek (they named it Arroyo de Santa Rosa) where "Great Captain of the Orcoquisac nation" Chief Canos lived, near the confluence of Spring Creek and the San Jacinto River (Location 20, Figure 4.10). He also heard from soldier Bernardo de Miranda, who had explored the Lower Trinity and San Jacinto rivers with a surveyor. Both Miranda and Del Río recommended the area around Canos's village as a possible site for a colony, and Barrios went to visit the site himself (Bolton 1970 [1915]; Woodrick and Linton 2009).

Miranda and his surveyor produced a map for their explorations of the Trinity and San Jacinto (Figure 4.17). His map (Figure 3.30), like so many Spanish maps of early colonial Texas, is garbled in its depiction of the coast but somewhat better in its depiction of the interior, reflecting the land-based character of early Spanish efforts. The San Jacinto River is shown as emptying into the Gulf of Mexico instead of into Galveston Bay; there is no Galveston Bay or Galveston Island; the Sabine River is left out except for the Sabine estuary and its Atakapan villages; the estuary is shown as connecting only to the Neches. Nonetheless, it gives a first glimpse of the array of Akokisa, Bidai, and central Atakapa living places. In particular, Chief Canos's village on Spring Creek is shown (Location 20 on Figures 4.17 and 4.10). Across Spring Creek from that village, the intended mission site at the Arroyo de




Santa Rosa that had been recommended by Miranda and Del Río is shown on Miranda's map. He also shows the Akokisa village of Calzones Colorado (Location 19), just up the Trinity from the presidio and mission at Orcoquisac (Location 10). He also shows "Atakapa" villages (as distinguished from the Akokisa band; these villages were of the Atakapa "proper" band of the larger Atakapa cultural group) on either side of Sabine lake (Locations 21a and 21b; more on them later). Not shown are the villages of El Gordo, El Mateo, and Tomás; he apparently did not extend his 1755 exploration that far to the west.

As a result of the various explorations over the period 1746–1756, the viceroy recommended that all of the Akokisa villages be "reduced" to one site, Santa Rosa del Alcázar, located at El Gordo's village on the west side of their territory, and that the swampy, mosquito-infested mission at Orcoquisac be closed. The site offered better chances for agriculture, it was thought, and more ready access to La Bahía, which was soon connected to this area with a road (Location 22, Figure 4.10). During the ensuing years of Spanish bureaucratic bungling and internal problems at the mission, these plans were never carried out. By 1771 the Orcoquisac mission was abandoned.

Juan Padilla was a Mexican government official and supporter of Anglo settlement in Texas. In 1820 he wrote a summary description of Indian groups in Texas that included the Akokisa who lived at the mouth of the Trinity River, close to or at the former site of Orcoquisac mission. His observations mark the last documented occurrence of the Akokisa at this formerly important site:

> *The Orcoquisac* [Akokisa] *are located at the mouth of the Trinity river. They number about 300 Indians. . . . Their occupations are limited to hunting and farming. They go down to the seashore from whence they secure the fragments of ships and other things cast up by the sea. They know how to manage a canoe, and they are excellent swimmers. They carry their furs to Carcashú [Calcasieu] and Oppelousás to exchange with foreigners who live in those settlements. . . . Their customs are very good, although idolatrous. They performed many services for the [Spanish] troops who were stationed at Atascosito, also called Orcoquisac, until the year 1812, when the frontier was abandoned.* (Hatcher 1919)

### Cazorla, and more communal hunting on the Katy Prairie, 1772

On or about the 24th of September, 1772, a military reconnaissance expedition

from the presidio at La Bahía (modern Goliad), led by Captain Don Luis Cazorla and on the hunt for French and English trespassers in coastal Texas, emerged from a Brazos River crossing at Raccoon Bend (Location 35, Figure 4.10) and encountered a large group of Indians from several coastal tribes working together in a communal deer hunt on the Katy Prairie. Cazorla's journal reads:

> *I discovered a ranchería of heathen Indians of the Carancahueces [Karankawa], Cocos, Vidais* [Bidai] *and Jaranames nations. Having managed to win their confidence, in order to inform myself concerning the matter that brought me here, and having seen in their possession sailor's shirts, others of fine cloth, red ribbons, and pieces of chintz, I succeeded. They told me that they had acquired all those things in trade with the foreigners who were [to be] found above the Orcoquiza [the recently closed Spanish mission and presidio in the lower Trinity River estuary], with whom they trade, and that they were even then killing deer in order to get skins for trading for powder, balls, and muskets, as well. . . . I had seen muskets which they had just acquired from the English, whose mark was on their barrels.* (Woodrick and Linton 2009:57)

The Indians told Cazorla that the French had traded the guns to them, having obtained them from the English. These Native Americans were all from coastal groups that ranged from the modern Corpus Christi area (the Jaranames) to the Trinity River (the Bidai). Cazorla does not mention the Akokisa, even though it appears the mixed hunting party was encountered at or very close to the former Akokisa camp of Chief El Gordo (Location 17, Figure 4.10; Woodrick and Linton 2009). It would appear that they were hunting deer either by driving them with or without fire, or by surrounding them, communal hunting methods that were earlier noted by de Vaca and Joutel. In the middle 18th century, large quantities of deer hides were being produced annually by Native American groups in Southeast Texas for trade (Bolton 1970 [1915]). Two centuries earlier, Cabeza de Vaca also noted friendly and cooperative relationships among several of these coastal Texas groups (Campbell and Campbell 1981; Ricklis 1996:97).

Besides the communal hunt already described, the Coco were known to hunt communally with other groups at other sites far inland from their coastal home between the lower portions of the Colorado and Brazos rivers. Fr. Gaspar José de Solís travelled from the Rio Grande into Texas in 1768 on an inspection tour, and encountered a joint party of "Coco, Mayeye, Jojuane, Tancagueye, and many others" just east of the Brazos near modern Bryan, Texas (Location 36, Figure 4.10; Foster 1995). Clearly, the Coco were mobile far into the interior for the purposes of either trading or hunting.

### Atakapa and burial mounds in the Neches-Sabine Lake area

Miranda's map of 1756 noted the presence of Atakapa villages in the area around Sabine Lake (Locations 21a and 21b, Figures 4.17 and 4.10). They were visited in 1777 by Fr. Juan Agustín Morfi, who was tersely unimpressed:

> *Although the Atacapas are to be regarded as dependents of Louisiana, they are numbered among the Texas nations because of the ease with which they changed*

> *their domicile, particularly since they are united with the Orcoquisas [Akokisa], with whom they form almost a single nation. They are friends of the Carancahuases whom they accompany whenever they can on their robberies. They live at the mouths of the Nechas and Trinidad Rivers, along whose banks they wander, without a fixed domicile; they neglect the cultivation of their fertile lands, occupy themselves with and live from robbery when they can manage to do so, or from the game which abounds in the forests. The nation is few in number and very cowardly, nor doesn't employ its arms except against beasts or the unfortunates who are shipwrecked.* (Morfi 1779)

Morfi's comment on "the ease with which they change their domicile" refers to the nomadic habits of these hunter-gatherer people that they shared with the Akokisa; they roamed the coastal area during warm weather, then gathered communally in the winter (Block 1976, 1977).

Juan Padilla described these Neches River Atakapa in 1820, 43 years after Morfi's visit; he called them the Nacazil, and his description of them is very similar to his notes on the Akokisa on the lower Trinity (given earlier):

> *The Nacazil live on the Neches River near the lagoons where it empties into the sea. They number about two hundred. Their customs are simple. They are fond of hunting and of farming. They frequent the seacoast and visit Atascosito when troops are stationed there. They are skilled in the management of canoes, and they go in them to Opeloussas and Carcashú* [Calcasieu] *with their products. They drink all kinds of liquors, of which they are very fond.* (Hatcher 1919)

Padilla's observations of these Neches Atakapa were to be the last. When Anglo keelboatman Thomas F. McKinney obtained a land grant in 1831 at Port Neches, the former village site described by Padilla and Morfi, the Indians were gone. Left behind were six large burial mounds that, according to the *Houston Telegraph* of June 2, 1841, contained a variety of artifacts, pottery sherds, and bones. According to Block (1977), the shell mounds were promptly mined for construction material and destroyed, excepting one mound, "150 yards long by 15–20 yards wide and 10 to 15 feet high" that was described by William Kennedy, the state geologist, in 1893 (Block 1977). The mound was destroyed, probably in the early twentieth century.

## The end of the French and Spanish contest for Texas

Meanwhile, the larger geopolitical sands were shifting. Following the close of the Seven Years' War in Europe, a peace accord signed in Paris in 1763 ceded Louisiana to the Spanish. This act changed everything along the Spanish-French frontier in East and Southeast Texas, because there was now Spanish control over both sides of the Sabine and Red rivers. There was now little reason to operate a mission at Orcoquisac, nor to pay any special strategic attention to coastal Atakapans, because they were now interior, not frontier, tribes. Indeed, Spanish attention was drawn much more to the attacks on their northern frontier by Comanches and Apaches. To figure out what strategic changes would be necessary all along the northern border of New Spain, stretching from what is now New Mexico to the old Louisiana border, the viceroy sent Cayetano Pignatelli, Third Marquis of Rubí, to sort out

the situation. He left in March 1766 and returned to Mexico in November 1767 (Foster 1995). His recommendations were to abandon all Spanish settlements at Orcoquisac and in East Texas (the missions and presidios in the Caddo area) and concentrate attention on New Spain's northern frontier at San Antonio and El Paso.

## Catastrophic population decline of Southeast Texas groups

Epidemic diseases cut their way through Native American groups on the Eastern Seaboard of North America in the sixteenth and seventeenth centuries. Death rates for Eastern America coastal groups reached 95% or more (Mann 2005). Similar large-scale destruction by disease appears to have come to the western Gulf Coast only in the late seventeenth and eighteenth centuries, as mentioned. The delay of these epidemics in reaching the western Gulf Coast underscores the utter remoteness of this region during the Spanish colonial era. The Texas coast in the early sixteenth century was a far-flung, dangerous and not too important place for the Spanish, who nominally owned it. Álvarez de Pineda, looking for an ocean passageway to the west, made the first circumnavigation around the periphery of the Gulf of Mexico in 1519, but there are no documents showing that he landed. Only with Cabeza de Vaca's visit of 1528 was there significant interaction in that century with coastal Texas peoples.

From the time of Cabeza de Vaca's landing in 1528—when Coaque and Han people contracted an unspecified stomach ailment with devastating results—until the end of the 18th century, one virulent epidemic after another pulsed through Akokisa, Bidai, and Coco settlements (Aten 1983; Ewers 1973), chief among them smallpox, measles, dysentery, and malaria. Historical occurrences of epidemic diseases spread among Texas Native American people were summarized by Ewers (1973), and his results are listed for Atakapa, Karankawa, and Tonkawa groups in Figure 4.18. Less visible in official records were chronic diseases like tuberculosis, influenza, pneumonia, and the like. Not only were genetics involved in making Native American people vulnerable, but "predisposing causes" like exposure to weather, malnutrition, alcoholism, bad sanitation and—especially as their situation became more and more precarious—despair (Aten 1983). In addition, as mentioned, the gathering together of Native American people in missions made them especially vulnerable to the spread of disease. By the early nineteenth century the few remaining Akokisa had merged with remnants of the Bidai (Smith 2005). Ewers (1973) noted that as of about 1890, the Karankawa, Akokisa, and Bidai were "essentially extinct."

After scouring historic documents of the early historic period, when French, Spanish,

Figure 4.18. A listing of epidemics affecting Texas coastal Atakapa (Akokisa and Bidais), Karankawa, and Tonkawa groups during the European colonial period. Summarized from Ewers (1973) and Ricklis (1996). Sources are cited by Ewers unless otherwise indicated.

| Year | Disease | Tribes infected | Location and mortality |
|---|---|---|---|
| 1528 | Cholera? | Karankawa | Follett's Island; half of local band, possibly more widespread |
| 1688-1689 | Smallpox | Karankawa | Fort St. Louis; French and probable Karankawa victims |
| bef. 1746 | Smallpox and measles | Tonkawa and Atakapa | Epidemics prevent population increase |
| 1750 | Smallpox | Tonkawa and Atakapa | San Xavier missions; 40 dead |
| 1751 | Unknown epidemic | Karankawa | San Antonio missions; Karankawa including Coco |
| 1753 | Malaria or dysentery | Tonkawa and Atakapa | San Xavier missions; "mortal sickness" |
| 1766 | Smallpox and/or measles | Karankawa | "Devastating scourge" |
| 1776-1777 | Unknown epidemic | Atakapa | Bidais population reduced by 50% (Bolton, 1915) |
| 1777-1778 | Cholera or plague | Tonkawa and Atakapa | Very high mortality |
| 1778 | Smallpox | Karankawa | |
| 1793 | Unkown sickness | Karankawa | Refugio mission; Karankawa including Coco |
| 1820s | Smallpox | Karankawa | Refugio mission (Oberste, 1942) |

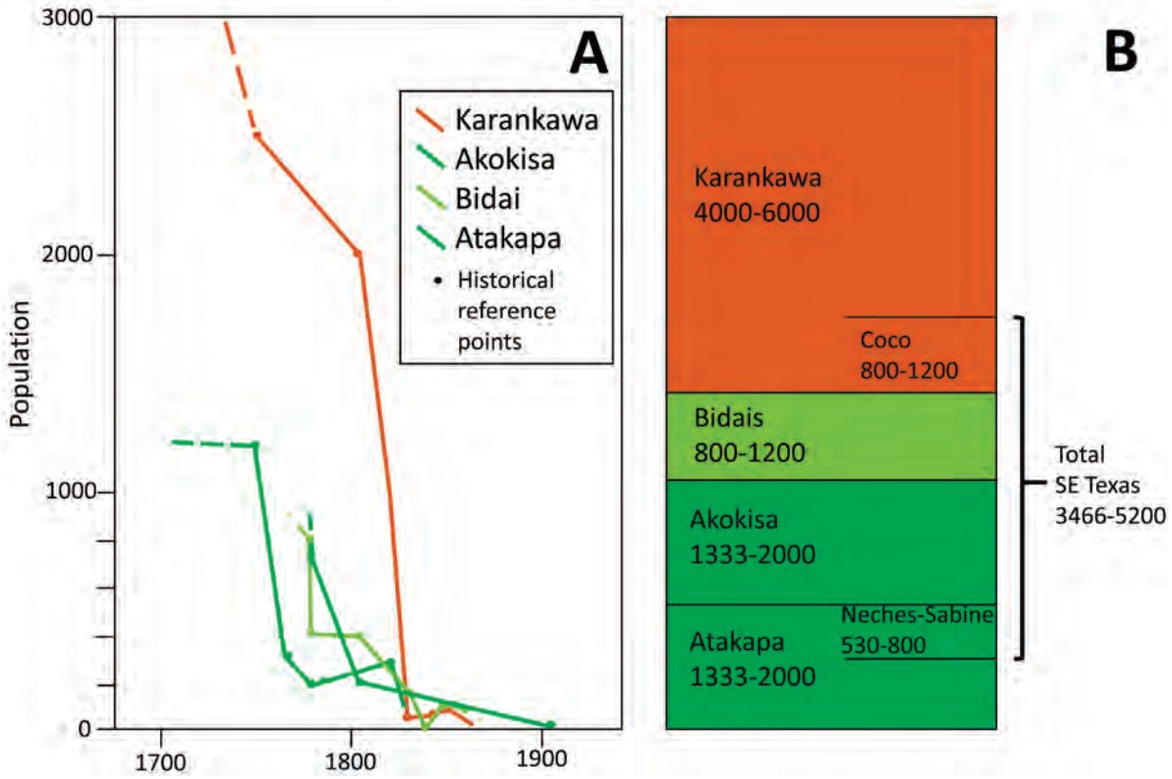



Figure 4.19. A: Population decline estimates for Karankawa, Akokisa, Bidai, and Atakapa (Neches-Sabine and Louisiana), projected from eighteenth- and nineteenth-century records, after Aten (1983). B: Maximum population estimates at ca. 1700 A.D., modified from Aten.

and (later) Anglo visitors interacted with Native American groups, Aten summarized the population estimates that document the rapid decline of each group. The source data are varied, sometimes vague, and at times contradictory, and Aten's estimates are not without risk of error—but they would seem to be as good as can be done at present (Figure 4.19A). The earliest population estimates are from the mid-eighteenth century, already during each group's fatal decline. European infectious diseases probably reached the Karankawa with Cabeza de Vaca in 1528, and even more probably by the days of La Salle's failed colony in 1688–1689. Smallpox and measles hit the Atakapa at least by 1746, and they might not have been immune to the diseases of de Vaca's visit. To project mid-eighteenth-century population estimates to an assumed maximum level ca. 1700 AD—before large-scale European intrusion—Aten estimated a lower case that merely projected first-known historical population statistics of the mid-eighteenth century to 1700, and a higher case assuming still more population losses occurred in the early eighteenth century that are not recorded. That gives a basic range of estimates for each group on the coast (Figure 4.19B).

If one further assumes that the Coco constituted one fifth of the five Karankawan groups, and that the Neches-Sabine band of Atakapa "proper" (the ones living in Southeast Texas) constituted about 40% of the total Atakapa population (which would also include the Calcasieu, Mermentau, and Vermilion groups in Louisiana), then one arrives at an estimate of from 3,466 to 5,200 individuals living in Southeast Texas in 1700.

With the Karankawan Coco, the crush of epidemics was exacerbated during the 1820s by dense plantation settlement by Anglo Americans and their enslaved African American servants of key hunting and fishing grounds of the

Coco along the Colorado and Brazos rivers in Matagorda, Brazoria, Fort Bend, and Wharton counties, discussed in Chapter 3. That settlement and the Anglo American population explosion that ensued resulted in mutual acts of violence that ended very badly for the numerically inferior Karankawa (Himmel 1999); this period is summarized further in the sections that follow.

## Anglo settlers encounter Akokisa, Bidai, and Atakapa remnants

Small groups of Atakapan people—last survivors of decimation by disease—still inhabited the Southeast Texas area as Mexicans and—shortly later—Anglo Americans took over the reins of power in Texas in the early nineteenth century. Visitor A. A. Parker (1835) noted that by 1835 in the settled eastern parts of Texas, it was rare to see Native Americans: "There are few remnants of tribes of Indians in the settled region of Texas. They are generally said to be harmless and inoffensive; doing nothing worse than stealing a hog or so, in a neighborly way, so that they may not be entirely forgotten."

These Anglo-American settlers provide our last documented glimpses of Native American people living in a traditional manner in Southeast Texas and adjacent southwestern Louisiana, with significant details of lifestyles that evaded many Spanish and French accounts. These include the last Bidai and Akokisa survivors in Grimes and Harris counties, the remaining central Atakapa band along the Neches River, and Louisiana Atakapa along the Calcasieu River in Louisiana, near modern Lake Charles. The final encounters of European immigrants with these groups were to be quite different from those with the Karankawa and Coco.

### Grimes County Bidai

The last stand of the Bidai in Grimes and adjacent Montgomery counties was noted by nineteenth-century Anglo observers, and these slim accounts tell us much about their lifeways. After dramatic populations losses—which included a disastrous Bidai smallpox epidemic in 1776–1777 that killed half of their number (Swanton 1946), and an earlier one at the San Ildefonso mission (one of the San Xavier missions) in 1750, already described—remaining Bidai merged around 1820 with the equally decimated Akokisa, with the tribal name Akokisa being dropped in favor of Bidai (Smith 2005:104). Nonetheless, Bidai survivors remained in a separate place on Grimes Prairie in eastern Grimes County and western Montgomery County until the middle to late nineteenth century. It was an area traditionally part of the Bidai winter hunting ground. Orobio Basterra noted the presence of a Bidai winter village in that immediate vicinity in February 1745 (that of Chief Tomás, discussed earlier; Location 15, Figure 4.10). Archeological data in the Lake Creek area (the creek has its hinterlands in the Grimes Prairie) support bison and deer hunting in the area in Early Ceramic and Late Prehistoric periods (see discussion in Chapter 8). The Grimes Prairie consists of a sizeable eastward indentation of grassland into the edge of the Pineywoods forest. This site would have allowed access to prairie game, including bison—which disappeared with the arrival of heavy Anglo settlement—and deer.

The nineteenth-century Bidai village was on Caney Creek, in between Nava-

sota and Montgomery on a Mexican land grant belonging to Margaret MacIntire (Location 24, Figure 4.10; Hodge 1907; Blair 1930; Gandy 1952). Margaret MacIntire was granted the land by the Mexican government via Stephen F. Austin in 1831, according to records at the General Land Office, but Anglo settlers started coming to the area in 1821 (Blair 1930). The Bidai settlement was described by an old settler named Anna Davis in 1925 as follows:

> *Bedias Indians had a village about six miles west* (of Montgomery) *on Caney creek. Here also was a burying ground, and arrow heads etc. are still found. They were friendly. Much trading was done between them and the whites. Indians exchanging baskets, wooden bowls, chairs of rattan and hickory, also covers for bottles made of rattan, for such supplies as they desired from the whites. Their custom was to bring baskets and proceed to fill them with whatever supplies desired and offer to exchange basket for its contents, even going to the milking pens of the Shannon home and having bowls filled with milk, after drinking which they would leave the bowl as payment. . . . The village was almost wiped out by typhoid fever. Their method of treatment was to place the patients on high scaffolds and build a smoke under them. Mat Shannon, who was then a boy, told Mrs. Willie Davis that he had seen as many as thirty of such scaffolds with dense smoke rising under them. Dr. Price, father of Mrs E. C. Wise, wanted to practice among the Indians but they refused, saying, "No good doctor, Bad Medicine."* (Davis 1925)

In like manner to the Bidai, Atakapan split cane baskets were also manufactured for trade in the late nineteenth century in nearby Louisiana and were prized items; a collection of them has survived in the Smithsonian Institution (Figure 4.3). The high quality of Bidai split cane and pine fiber furniture was noted by Rubí in his 1767 tour of coastal Texas (Foster 1995).

The Bidai had been driven off their traditional lands along the Trinity River by Anglo colonization; the river valley was surveyed, plots were granted to Anglo settlers, and land was cleared for cotton cultivation in the 1820s. As a result, the few remaining Bidai were pushed aside into the remote prairie, where Anglos arrived a bit later. In 1830 Jean Louis Berlandier, on an exploratory trip to Texas on behalf of the young government of Mexico, noted that the Bidai settlement there had only about 220 persons, living in desperate conditions. He noted that they claimed to be the most ancient of all Texas tribes, but

> *demanded to know why the [Spanish and later Mexican] government has given so much of their land to the colonists. These poor wretches live in great poverty. Not knowing how to cultivate so much as an acre of land, they live by hunting deer, since the other nations will not allow them to enter the buffalo ranges [to the west].* (Berlandier 1969 [1830])

Bollaert (1956 [1842]), travelling in the Grimes Prairie area in 1842, noted that "Bidai live and hunt about Cincinnati [a now abandoned town along the Trinity River in northern Walker County] and the prairies toward Lake Creek in Montgomery County—there are but few of these; less than the Cushattes [Coushatta, recently arrived from the southeastern United States]." Hodge (1907) adds that the nineteenth-century Bidai were friendly, hired out as cotton pickers, cultivated

maize, and bore "faithful allegiance" to the Texans, no doubt helping them to remain on land that legally belonged to others.

Being in a relatively immobile spot probably did not help the village sanitation for such a traditionally mobile group, and the early nineteenth-century typhoid epidemic mentioned may have been related to that. It has been said by John Ewers, in his notes accompanying the modern publication of Berlandier's report of 1830, that some of the survivors were forcibly moved to the Brazos Reservation in 1849, and then on to Oklahoma in 1854, to the Wichita Reserve. The source of that conclusion seems to be a report on the early history of Texas by Clarke (1905), who mentions that "all the Caddo tribes—Caddoes, Adaes, *Bedaes* [emphasis added], Keechies, Nacogdoches, Ionies, Andadaques, Wacoes, Tawakanoes, Towash, Enquisacoes, and Tejas—although at the time of the establishment of the reserve many of them were only feeble remnants, were placed upon the Brazos Agency and called for convenience 'Caddoes.'" Available historical information does not allow independent documentation of the inclusion of the Bidai in the Caddo removal. In any event, Blair reports that by 1860 only six Native Americans remained in Grimes County, three by 1870, four in 1880, and none in 1890. In 1912 Swanton reportedly made a diligent search for survivors but found "only one Indian of probable Bidai blood" who "had been brought up in a white family and knew nothing of the language or customs of her people" (Swanton 1946). One would assume that any Bidai not succumbing to disease or possible removal to Oklahoma would have found employment outside the old village, and thus gradually melted away into the general population.

### Cypress Creek Akokisa and Bidai

A similar fate befell the Akokisa in their last known communal residence in Harris County, although—rather amazingly—they carried on into the early twentieth century. They lived along Cypress Creek on land homesteaded by Matthew Burnett in 1836, near modern Telge Park (Location 25, Figure 4.10). Burnett's daughter, Rebecca Burnett Lee, wrote about these people. She described their settlement as a "wigwam town," with a chief named Francisco (Moore 1996). They self-identified as Bidai, but as we have seen, the Bidai and Akokisa groups had merged by 1820, taking the name Bidai, and this particular group of survivors lived on Cypress Creek, a hunting area associated with Akokisa from the time of Orobio Basterra's expedition in 1746 and Miranda's exploration in 1756.

Rebecca Burnett recalled that the group periodically danced in a bark pavilion, and that Chief Francisco played a rhythmic musical accompaniment by rubbing a small stone over a stretched alligator skin, producing a "honk-honk" sound as the people sang. She also described the preparation of a bread called Pontuck, made from the tuber of a wild plant (Moore 1995).

A few years later Chief Francisco's group is seen at a second location, along Willow Creek, about ten miles north of the Burnett farm; the creek runs between Tomball and Klein. The baptismal records for St. Vincent de Paul Catholic Church, founded in 1841, have the following entry:

*November 24th, 1846*
*I baptized at the Indian Camp on Willow Creek*
*Elizabeth, age 7, born of Billy and Sally*
*Joseph, age 5, born of Michel and Sally*
*Mary Anne, age 3, born of Johnson and Betsy*
*Mary, age 6 months, born of Jim and Harriett*
*Charles, age 7, Francisco godfather.*
*Francisco their Chief being sponsor, who was a Christian baptized by a Spanish Priest.*

*J. Lynch*

It would seem from this entry that in the 1840s, the group was still able to move about in search of game. The entry also makes it clear that Francisco was by this stage a man of advanced age, as the entry states that he had been baptized by a Spanish priest.

The Burnett land was eventually purchased by German immigrants named Telge in the 1850s. Chester Telge, born on that property in 1918, recalled that the Bidai were still there in his youth. In an interview with archeologists Roger A. Moore and Madeleine Donachie, Telge described how the Indians lived in hide tents on pimple mounds, and said:

> *His father and grandfather gave the Indians beef and hides periodically, and [he] went on to describe a charming incident of reciprocity. On baking day, his grandmother would wrap up a large loaf of bread and leave it on the back porch. By sundown, the Indians would have exchanged it for a large catfish. . . . The end of the Bidai's occupation was marked by the day in the early 1920s when the loaf of bread remained on the porch past sundown. Chester's grandmother brought the bread back into the house, and announced in German that "the Indians are no more."* (Dial and Black 2015)

## Addicks Mound Akokisa

Of another Akokisa site that still existed at the time of Anglo settlement, even less is known. Joel and Elizabeth Wheaton moved to the area around the future Barker Reservoir in 1831, operating a frontier inn and farm at a prominent ford on Buffalo Bayou (Location 26, Figure 4.10). That property was purchased by William J. Habermacher in 1869, and his daughter Kate Habermacher (1874–1957) was born there and lived in the house throughout her life. She told stories related to her by her parents and neighbors of "Indians" who used to visit the property: "The Indians came in large numbers and camped near Buffalo Bayou near the Habermacher Crossing. In 1875 they suffered from a severe winter and many died. This was the last time that a large tribe ever came." (*Houston Chronicle*, February 13, 1949)

In the 1940s archeologist Marshall Black visited Kate Habermacher and began to excavate Addicks Mound, a small Early Ceramic through Late Prehistoric elevated burial mound located along Buffalo Bayou about a quarter mile east of the Habermacher house. Adjacent to the mound was a large site of perhaps two or three

acres that was very rich in projectile points of a wide range of ages, and many flakes; clearly it was a past habitation site. Habermacher recalled local lore that there had once been a "big battle" there between whites and Indians (Black 1985). Habermacher's grand-nephew Randy Harmon, of Bellville, grew up with Habermacher at that site and recalls that she spoke often of the Indians who visited the site for many years, and that they were motivated to keep returning to the site to "visit the place where they were born" (Harmon, as interviewed by the author in 2017). This would seem to indicate that the displaced Indians were Akokisa. When Joel and Elizabeth Wheaton obtained their land grant in 1831, establishing an important crossing and frontier inn for the San Felipe to Harrisburg wagon trail—a significant road in colonial and early Republic-era Texas (Worrall 2016)—those earlier Native American residents may have been pushed aside, perhaps violently.

The site is close to a number of significant archeological sites excavated by Wheat (1953) and within the important Paleoindian through Late Prehistoric Period bison hunting zone described in Chapter 8. It seems clear that Akokisa still lived in the area at the beginning of historic time, although the site was apparently never visited by the Spaniards. There was a frontier path leading to the Burnett farm, and it seems possible that the displaced Akokisa may have joined their tribal Bidai kin along Cypress Creek, but continued to visit the Buffalo Bayou site of their birth for years to come on annual hunting trips. The practice was cut short by the epidemic disease in 1875 that Kate Habermacher mentioned, which may have struck the Cypress Creek site.

There clearly were individual survivors of the Bidai and Akokisa groups long after the above last known villages disappeared. They would likely have melted away into the population as laborers, or migrated farther into remaining bits of wild places, like the Big Thicket. By the 1870s, when Kate Habermacher recalled the last visit of the Indians to her farm, sightings would have been rare indeed, and worthy of note.

### Calcasieu River Atakapa

There are several detailed accounts of the lives of Atakapans living along the lower Calcasieu River and the adjacent coast that were collected by Dyer (1917) from visits made separately by a Colonel Graham in 1819, a Colonel Warren D. C. Hall during the period 1817–1819, and a Greek sailor named Nicholas in 1819.

**Houses**. Graham, who was passing through the region, suffered a bout of acute dysentery during the cold October of 1819 and stayed as a guest of the Atakapans for several weeks while he recovered. From him, by way of Dyer (1917), we have the most detailed description of the dome-shaped, skin-covered Atakapan homes:

> *They received Graham hospitably, and placed him in a vacant hut. This was extremely filthy . . . its sides were made of poles interwoven with vines, and the conical top was open in the center to allow the smoke from below to escape; the fireplace of oyster shells (a mere pit) being in the middle of a dirt floor. Only one opening was provided, serving as door and window, and closed by a heavy hide suspended by a crossbar. . . . His bed was a slightly raised platform of drift wood, covered with moss and skins. A fire was kept up day and night and water poured*

*on the hot oyster shells of the fireplace, keeping the hovel steaming hot.*

**Appearance**. Colonel Hall, shipwrecked on Galveston Island in 1817, walked to the Calcasieu village and stayed for a time with the Atakapans. Hall was familiar with a number of Indian groups of the Texas and Louisiana coast, and from him we have a description of Atakapa physical features as compared to those of the Karankawa, again relayed by Dyer (1917):

> *Early in 1817 the village contained forty miserable, dirty huts, the chief's and shaman's being on an oyster mound, and somewhat larger in size. They had no temple and no ceremonials, except the "chi" dance, which was patterned after that of the Carancahuas. . . . The tribe, Hall likened to the type of the Toncahuas* [Tonkawas]*; men of short stature, large heads, dark skins, and prominent facial features . . .; especially noticeable were the high cheekbones and protruding lips. Whilst in many customs . . . the Atakapas followed the Caranahuas rather than their kindered away from the coast, there was no racial affinity whatsoever, the Carancahuas being tall, slender, agile, light-skinned, yellow haired, and with regular features and white teeth. . . .* [The Atakapas'] *teeth were stained from the various leaf substitutes they used for tobacco. Head deformation, cuts on the nose and chin, and tattooing were noticeable, especially in the older members.*

**Fishing and trading.** Graham described the Atakapan process of spearing and harpooning fish as follows:

> *The tribe were skilled fishermen, but their dugout canoes being frail, they never ventured into the Gulf for any distance. They did not use the bow and arrow to any extent in fishing, but depended upon darts and spears, which they were able to fling with unerring accuracy. Graham saw them hit (in the saltwater lagoons connecting with the Gulf) small fish but ten inches long at a distance of twenty paces. The darts tipped with bone were used for short distances and floated, while the heavier flint-tipped harpoon had a wooden floater attached to a thong, which enabled them to retrieve their weapons, as well as tire out a wounded fish. Flounders were speared by torchlight, with a short-hauled dart, tipped with a bundle of sharp-tipped bones.*
>
> *. . . The dugouts were propelled by paddles and poles, and were clumsy logs, hollowed out and one end sharpened. Small lagoons, subject to tidal flow, were cut off by traps made of brushwood in which the receding tide left behind numerous small fish.* (Dyer 1917)

The use of dugout canoes for fishing and the trapping of fish in weirs were common activities for Native Americans from the Eastern Seaboard to Texas; early settlers in Virginia in the late sixteenth century saw what Graham observed over two centuries later in the Atakapa camp (Figure 4.20).

Fish was cooked by various means:

> *Flounders were cooked whole in a pit, the fish being placed one above the other. When dried, they were split in halves. . . . Small fish of all kinds were dried by being impaled on reeds and smoked over banked fires. . . . These*

*fish formed an article of barter with tribes of the interior, and were esteemed a delicacy by the Opelousas, who traded flint for them.* (Dyer 1917)

According to the Greek sailor Nicholas, they traded other marine items with inland tribes: "The tribe furnished the Indians to the north with shark's teeth, marine curios, dried or smoked fish, feathers and seaweed, esteemed as medicine. The plumes of the heron, crane and pelican, as well as of the wild geese, were especially in demand." He mentioned that wives were also bartered for with adjacent groups, "the men in the clan outnumbering the females" (Dyer 1917).

**Shell middens.** Graham's account is also a prime first-hand source for understanding the origin and construction of Atakapan shell middens:

> *This tribe ate all kinds of shellfish; in fact, seemed to have no taboo-food. Oysters were obtained in the salt-water lagoons, being dragged from the shell bottoms with rakes made of two strong poles, curved at the ends and interlaced with strong vines. The drag brought up clumps of live oysters, fastened to the shells of former generations. The old shells were always detached and thrown in the water, while the heaps of shells accumulating from oysters consumed were placed in a mound in the village, upon which stood the lodges of the head man and of the shaman. Graham, curious whether the dead were buried in the mounds, was told by the shaman that the dead and the living "could not live together." Hence, it is presumable that the dead were placed, at first, in out-of-the-way places.* (Dyer 1917)

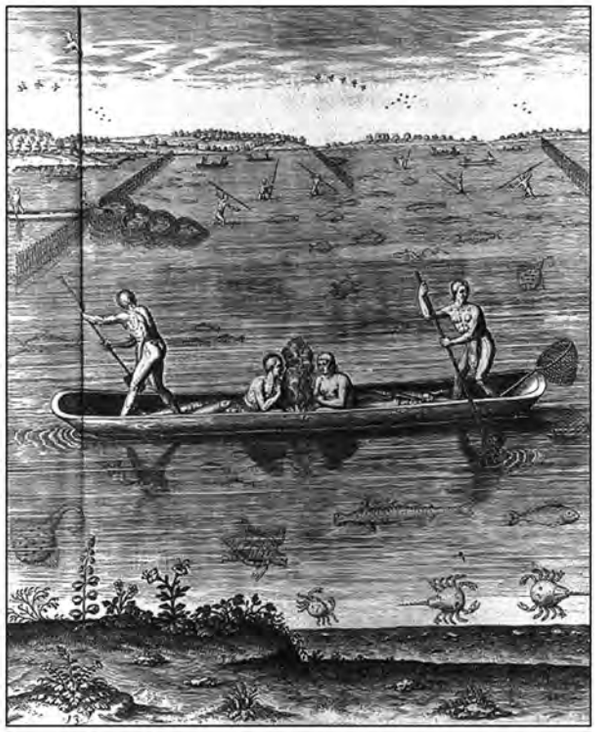


Figure 4.20. Native American men and women fishing from a dugout canoe and spearing fish trapped in weirs (background) in coastal Virginia, 1590, as drawn by John White and engraved by Theodor de Bry. Courtesy of the Library of Congress.

**Alligators as food and as source of skin lotion.** According to Nicholas:

> *The saurian* [alligator] *was speared in the eye, and disemboweled on the median line, where the skin is thin. Owing to the difficulty of cutting the horny hide, the carcass was left whole after gutting. Along each side of the spine a long trench was made by removing the flesh, and the belly skin was replaced and tied. The carcass was now placed in a pit of red-hot oyster shells, and covered with live charcoal. In a few hours the skin, though charred, still held the baked flesh and oil that had gathered in the trenches. This oil was served as a delicacy, and placed in jugs for future uses; an essential one was for body inunction, which kept off mosquitoes and gnats, prevented the terrible "water sunburn" of the body, and lastly was believed to render the swimmer more buoyant. The alligator oil was [also] used in their lamps; as torchwood was often scarce or wet. The lamp was a large shell containing a wisp of moss, curled into a wick. The smell was abominable.* (Dyer 1917)

**Decline and disappearance.** Dyer noted that the last account of the Calcasieu coastal Atakapa village known to him was taken from some remarks made by Jane

Figure 4.21. Armojean Reon of Lake Charles, Louisiana, ca. 1909. He was one of the last Atakapan speakers and a source for some of Swanton's ethnologic and linguistic studies of the Atakapa. Photo from Swanton (1911).

Long, who famously wintered over on Bolivar Peninsula in 1820 and met Colonel Hall, her escort home, at the Calcasieu village. Dyer reports that after 1820 the Atakapans at the village were quickly surrounded by white settlers, and gradually amalgamated with them. By the time that ethnologist John Swanton studied Atakapa culture in the early twentieth century, nearly all survivors of the Calcasieu band known in southwest Louisiana who could still speak the Atakapan language lived in or near Lake Charles (Location 27, Figure 4.10). When Swanton visited them in 1907–1908 to record their language, only nine still spoke it (Swanton 1911), including Armojean Reon, who by that time lived in Lake Charles (Figure 4.21). In the 1930s a neighborhood of Lake Charles that straddled an abandoned rail line became known as the "Dummyline" for an abandoned ("dummy") railroad line. It was populated by a mix of Atakapans, African Americans, Caucasians, and Creoles. The Creoles were a growing mixed-race group whose heritage was composed of elements of the former three. Historian and Atakapan descendent Hugh Singleton was raised there and remembered the idiomatic flavor of their local speech at that time, peppered with Atakapan phrases and manners of speech (Singleton 1996).

### Mermentau and Vermilion Rivers Atakapa

The farthest east group of Atakapa were those living along the Mermentau and Vermilion rivers as well as their tributary bayous (see Figure 4.1 for location), and southwest of the town of St. Martinville (formerly, *Poste des Atakapas*) north of Vermilion Bay. In the headwater area of the Mermentau and Vermilion rivers lies the town of Opelousas, named for the group of inland Atakapa who lived there; the name meant "black hair" in the Muskogean language (Post 1962). French trappers first ventured into this area in 1690 and soon began to acquire land from the Opelousas. By the end of the 18th century, there were few left. The best single record of this group is from land purchase papers of that era, as in this document a settler named Andre Martin documents his land purchase with the American government:

> *Andre Martin claims 1523 acres on the river Nementou [Mermentau], by virtue of a purchase from the Indians of one of their villages, which claimant sets forth in his notice was purchased in the year 1799. . . . With the notice of the claim is filed a play of a survey . . . dated in 1806, and the deed is from Celestine Le Tortue, chief of the Attakapas Indians, for 40 arpens front by the depth of forty arpens, on the right bank of said river, adjoining the lower side of the village then occupied by the Indians . . . price one hundred dollars. Louis de la Houssaye, aged 52 years . . ..deposeth "that from the earliest recollection of the deponent, Nementou, the chief of the village on the river of that name, with the other Indians of the tribe, were residing on the land now claimed by Andre Martin. . . . Being requested to state how many villages of the Attakapas or Opelousas Indians, in the district composed of the counties of Attakapas and Opelousas, he had known, where were the situations of those villages . . . and the date of settlement and abandonment of those villages, and the number of inhabitants, answereth, that a village of Attakapas Indians was established on the west side of the River Nementou . . . Nementou was chief. The inhabitants of this village were very numerous when the deponent first knew it. He recollects that about thirty years past, when there*

*was a Spanish expediton against Baton Rouge, there were about 400 warriors who joined the Spanish army, of which 120 were from the Nemetou village, sixty from the village of the Vermilion, of which Skenemo was then the chief; that Skenemo's village was on the west side of the River Vermilion . . . at the place now occupied by Anselm Thibadeau . . .; that he has been informed that there was another small village of Attakapas Indians low down on the Vermilion, but not having ever been at it, he does not know what the chief was called; that he has heard of several other villages, of Attakapas and Opelousas Indians on the Bayou Plaquemine Brulee, and the other parts north and west of that Bayou, but never was at them.* (American State Papers–Public Lands, as quoted by Post 1962)

Such land purchases, as Post observes, were problematic, as Atakapas—like most Native Americans—did not have any concept of individual ownership of land. Nonetheless, the Spanish government recognized such purchases, but at the same time also granted to Indians ownership rights to their immediate villages, when requested. To quote Post, "With the loss of their lands and the pressure from white occupation, the Attakapas declined in numbers. It is likely that the white man's liquor and diseases had much to do with the decline."

By the early years of the nineteenth century, Atakapas of the Opelousas and St. Martinville area were ranching cattle, and brand registrations at the *Poste des Attakapas* (St. Martinville) record the names of some of them, including "Bernard, Chef des Atakapas, August 18, 1801," and "Celestin Sauvage, St. Landry, June 13, 1808" (from the *Book of Brands for the Districts of Opelousas and Attakapas, 1760–1888*, as quoted by Post). With time, such entries disappear, as Atakapa descendants blended into the Creole population and in effect disappeared as a distinct cultural entity.

Since the early nineteenth century, remnant Atakapan culture in creole Louisiana (those who lived in the Calcasieu, Mermentau, and Vermilion river basins) has become more diffuse and often forgotten; the people have "disappeared" in plain sight. In an effort to counter this perception, a meeting was held in Lafayette in 2007 to gather together those of Atakapan ancestry, and to begin a project to gain federal recognition of the tribe; over 80 people attended, primarily from southwestern Louisiana and Southeast Texas. The group is designated as the Atakapa-Ishak Nation, and grapples with the issues that, largely because of their people's mixed-race status today, Atakapan contributions and qualities have been relatively ignored, and that many historians—and archeologists—keep up an erroneous mantra that the group is extinct (*Times of Acadiana* 2007). During the British Petroleum Deepwater Horizon oil spill of 2010, a news media spotlight briefly shone on a tiny struggling Atakapa village called Grand Bayou, just northwest of Port Sulphur, Louisiana, in southern Plaquemines Parish. Here a group of mixed-race people still self-identifying as Atakapa-Ishak and Chawasha Indians make a living in a traditional manner, fishing on Grand Bayou. Their survival is in question, not only from the after-effects of the oil spill, but because of the dramatic amount of land loss around their village due to subsidence and erosion in recent years (Marshall 2016).

## Last stand of the Coco and Karankawa

Although the Coco and Karankawa had survived over a century of the Spaniards and their attempts to "reduce" the Indians to mission life, nothing could prepare the Karankawa, and especially their Coco band, for the juggernaut of Anglo settlement by Stephen F. Austin's colony, beginning in 1821–1822. The continued hostility of Karanawa toward Europeans had begun, or so Jean-Baptiste Talon had said, in 1685 when La Salle's men arrogantly stole some canoes from the until then friendly Karankawa. The hostility continued when Spanish search parties found La Salle's site, and seemingly never ceased. Karankawas were the scourge of mariners shipwrecked on the coast, and their reputation held back Spanish surveying efforts to understand the complicated barrier island coast. Raids by Karankawan apostates at La Bahía mission on the Guadalupe River constantly disrupted Franciscan missionary efforts. By 1779, after Louisiana had been ceded to Spain, an exasperated Atahanase de Mézières recommended to his Commandant-General Croix that nothing would solve the situation other than a war of extinction on the Karankawa, by land and sea (Weddle 1995). It was never carried out.

All that was the preamble to the arrival in 1821 of Stephen F. Austin and the founding of his new capital in San Felipe (Location 27, Figure 4.10). Austin's colony, the boundaries of which are outlined in magenta on Figure 4.22, had at its center the acquisition of rich bottomland soil of the Colorado and Brazos rivers, and the colony's purpose was large-scale cultivation of cotton in those bottomlands. The core area of early land grants (the "Old 300" grants of 1821–1824, shaded in

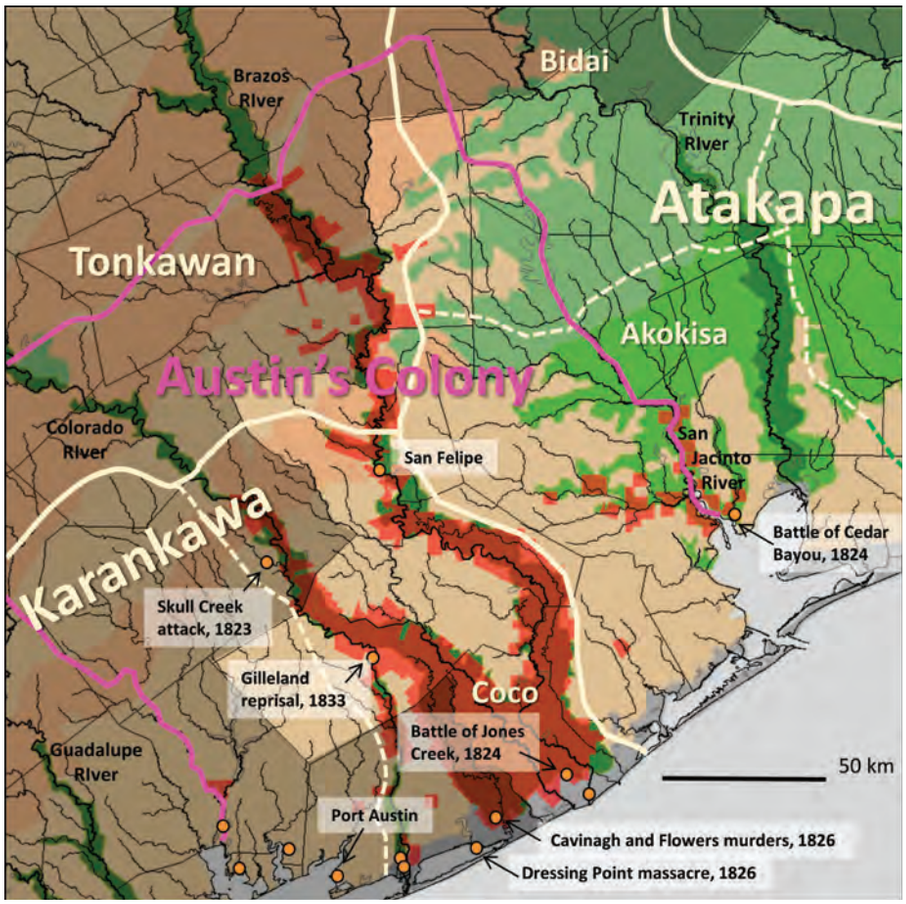



Figure 4.22. The area of Austin's Colony, outlined in magenta, and the tracts of the first 300 colonial grants of 1821–1824, in semi-transparent red. The early tracts negated nearly the entirety of Coco river bottom land. Orange circles indicate nineteenth-century sites that are dis-cussed in the text. Outlines of Native American territories are as described by Swanton (1911) for the year 1700 (solid white lines) or with the addition of approximate band boundaries (dashed). The background is from the ecoregions map shown in Figure 3.7.

semi-transparent red in Figure 4.22) covered all the river areas inhabited by the nomadic Coco. Immediately, settlers began pouring in from the old South, where they had left behind worn-out plantations. Each land grant required that the land be worked and lived upon, and by 1824 the land map was as shown in red. Each grant had a settler family plus a number of enslaved African Americans whose jobs were to clear the forest and plant cotton. Trees were girdled and killed (see Figure 3.4 and discussion, Chapter 3), and the forested landscape quickly changed to cropland. The Spanish had established only a few small mission settlements and farms; in contrast, Austin's colony constituted focused regional agribusiness with hundreds, and soon thousands, of newly arriving people.

The effect upon the Coco was immediate and devastating. They were being swept aside from not only their land but their livelihood. Coastal and river fishing sites were taken over for ports. River bottoms and forests, including all-important hunting areas adjacent to the San Bernard Prairie, were taken over for cotton production. It was obvious to the Coco and their Karankawan neighbors that their starvation would be the sure result. The Anglo settlers, for their part, had legal writs from the Mexican government, officially signed by Austin, and big plans. There was little if any planning done on the fate of the coastal tribes. So began one of the ugliest and most violent chapters in Texas history.

The Coco, as already noted, sometimes acted with the Karankawa, and at other times acted independently. They apparently spoke Karankawan, if a letter of 1797 from the commander at La Bahía is to be credited; Juan Elquezabal claimed that the Karankawa and Coco then at the mission were "all one nation, and of one language" (Ricklis 1996). As mentioned, the Coco were not happy to be at the La Bahía mission with the Karankawa, and were brought into the first San Xavier mission in 1745, along with Atakapan Akokisa, Bidai, and Deadose. Unhappy there, they left, but the Spanish built a special mission for them at nearby Candelaria in 1749. At the time of Rubí's inspection of 1767, the Coco were living in San Antonio de Bexar along with many central and south Texas tribes—again, not including other Karankawan groups. But by 1793 Cocos were living alongside Karankawa at the new mission of Refugio, near present day Refugio, Texas (Ricklis 1996). From all this we can infer that the Coco were a people somewhat removed from the rest of the Karankawa, but Karankawan speakers, and not close enough to the Atakapa to wish to live with them. Archeological evidence presented in Chapter 8 shows a mix of Late Prehistoric Atakapan and Karankawan pottery styles at their interior hunting camps in Wharton County, supporting the idea that the group lived in a niche between the two cultures.

Regardless of the confusion in the literature about the cultural affiliation of the Coco, the colonists knew that the Coco often associated with Karankawa, and because of that were wary of them. In September 1821 Stephen F. Austin, on his first visit to his intended colony, warily encountered some Coco while on a surveying trip along the lower Colorado River. The Coco were outwardly friendly, but nonetheless Austin recorded in his diary that he thought of extermination as a solution to their unwanted presence:

*Monday* [September] *17: Started early and continued a S.E. course along the*

*Lake—at the lower end the Indian war whoop was raised . . . and I immediately . . . descried an Indian coming towards me, who beckoned me to* [stop] *& made signs of Friendship.* [He] *advanced towards me into [the] Prairie and was followed at a short distance by 14 warriors.* [I] *advanced about 20 yds ahead of [my] company directing them to be prepared for battle if necessary. . . . Chief asked me in Spanish* [where I] *was from and where going.* [I informed him] *. . . he said they were Coacos . . . who I knew lived with the Karankawas. . . . This induced me to watch them closely and refused to go to their camp or to permit them to go up to the men, untill one of the chiefs laid down his arms and five squaws and a Boy came up to me from their camp—this satisfied me they believed us to be too strong for them and therefore that they wd. not attack us (of their disposition to do so I had no doubt, if they thought they could have succeeded) some of the warriors then went up to the* [men] *and appeared friendly, I gave the chief some Tobacco and a frying Pan that we did not want and parted apparently good friends—there was 15 warriors in the group . . . The chief informed me that they were going to encamp on the road to trade with the Spaniards & Americans—he said we cd. not reach the mouth of the river with Horses owing to the thickets he also said that there was a large body of Karanquas at the mouth.*

*These Indians were well formed and apparently very active and athletic men, their Bows were about 5-1/2 to 6 ft long, their arrows 2 to 3 well pointed with Iron or Steel. [Some] of the young squaws were handsome & one of them quite pretty—they had Panther skins around their waist painted, which extended down to the knee & calf of the leg—above the waist tho. they were naked—their breasts were marked or tattooed in circles of black beginning with a small circle at the nipple and enlarging as the breast swelled.*

*These Indians and the Karanquas may be called universal enemies to man—they killed of all nations that came in their power, and frequently feast on the bodies of their victims—the* [approach of] *an American population will be the signal of their extermination for there will be no way of subduing them but extermination.* (Austin 1821)

Here are two future enemies meeting at the very beginning of the Texas colony: one professing friendship, the other intent upon removal. Austin's physical description of the Coco is very similar to the drawing of them by Jean Louis Berlandier, who visited on behalf of the Mexican government a few years later (Figure 4.5).

As settlers began to arrive, the violence began. In 1822 either the Karankawa or the Coco put to death a group of men left in charge of a flatboat loaded with goods bound for Nicholas Clopper's general merchandise store in the brand new town of San Felipe (Gatschet 1891; Clopper 1950). One of Clopper's sons, Nicholas Clopper Jr., and at least two other men were brutally killed and the boat was destroyed, near the mouth of the Colorado River. It took the news quite some time to reach the family, in both Texas and Ohio, and the hatred ran deep. By 1827, even Nicholas Jr.'s sister Rebecca Clopper had given up hope of ever seeing her brother again, and wrote in her diary:

*No hope have I they spar'd thy life,*
*But tomahawk or scalping knife*
*Has caus'd thy heart's blood deep to flow—*
*And plung'd thy sister's heart in woe.* (Clopper 1950)

By this time, Karankawa were known to be venturing east of their Matagorda Bay lands into Galveston Bay and even farther east (Dyer 1917; Aten 1983), due perhaps to the disruption of Coco territorial grounds or perhaps opportunistically, invading the space of the Akokisa, whose population was crashing. Hancock Hunter came to settle in Texas in 1822 with his father, Johnson Calhoun Hunter (1787–1855). They first landed in San Jacinto Bay, and after a rough time of it made their way to Galveston and then to what is today Morgan's Point in San Jacinto Bay, near the mouth of Buffalo Bayou. He recounted a pair of clashes between Karankawa and settlers at Cedar Bayou in the early 1820s, just across the water from Morgan's Point, near the mouth of the San Jacinto estuary (Figure 4.22):

> *The Tankaway Indians [Tonkawas], & Cronks [Karankawas], ware hostile & troubled the whites. Tha lernt how to give a signal, by putting up a white flag. There was two fameleys come up from Galveston in two small boats. The Cronks put a white flag on the beach at little seder Bayou & the boats went a shore. The Cronks run on them & kild them, 3 men 2 wimmen & 4 or 5 children. One man got a way, by jumping out into the bay swiming & wading about 4 or 5 miles across to the point, & came around to Pas. Pa & a man by the name of Fowler, got in thare boats & collected some 10 or 15 men, & went down to little seder Bayou that night, & found the Indians, a kooking the peoples hands & feet & eating & dancing. The whites lay close in the grass by them untill day light, & fiard into them, & kild 15 or 20 of them, & the balance left. Tha never bothered us anymore.* (Hunter 1860)

There is no doubt that not all tales of Karankawan cannibalism are true, but the observations of numerous Spanish, French, and Anglo observers are not all to be easily dismissed.

In 1823 in the upper part of Coco territory, on the Colorado River at the mouth of Skull Creek (the site is shown in Figure 4.22) three men in a canoe returning from a trip to buy corn were waylaid by "Karankawa"; two were slain and a third was wounded. Another settler was severely wounded the next day, when he approached the same group of Indians, thinking them friendly. Immediately, a company of fourteen settlers was raised, found the encamped Indians, and opened fire, killing nineteen of the twenty-one. Little resistance was made (Wilbarger 1890; Gatschet 1891). As in the Cedar Creek clash, Karankawa (or Coco) casualties were disproportionally larger.

Such was also the case in 1824 at the battle at Jones Creek, near modern Matagorda town (Figure 4.22). Several emigrants working their way up the Brazos to settle were slain by Karankawa (or Coco). A company of men was raised and learned that 30 warriors were encamped on Jones Creek, with another dozen warriors having gone up the Brazos to obtain more ammunition. The latter group was waylaid by Texians with some Indian casualties, and the rest were located the following day.

The Texians surrounded their camp at night and took them by surprise, opening fire in the morning, as at Cedar Bayou, killing fifteen and wounding others. Three settlers were killed (Wilbarger 1890; Gatschet 1891).

The war of attrition clearly was not favoring the Karankawa. In late 1824 Stephen F. Austin appointed Captain Abner Kuykendall to expel the Karankawa, and presumably the Coco, from his land grant. The Indians were routed and fell back toward the La Bahía mission (modern Goliad). A mission priest took the Indians under his protection, and met with the colonists, in the presence of Mexican officials. The Indians agreed never to venture east of the Lavaca River, effectively ceding their Colorado and Brazos River homelands and Matagorda Bay.

These were promises that the Karankawa and especially the Coco could not long observe, however; the Texas coast south of the Nueces and Lavaca Rivers is a dry and hostile environment for a hunter-gatherer people, and in any event it was already populated with Coahuiltecan groups. The Indians were soon back, raiding along the Colorado River (Gatschet 1891). In 1826 the wife and three daughters of Charles Cavinagh, who lived on Caney Creek near Live Oak Bayou (Figure 4.22, bottom center), were murdered, and another daughter was severely wounded, while Charles Cavinagh was at some distance away. At the neighboring Flowers farm, Mrs. Flowers was killed and her daughter was wounded. Immediately, Charles Cavinagh raised a company of 60 men and pursued the Indians, catching up with them at Dressing Point, on the shore of East Matagorda Bay (the site is located on Figure 4.22). The Indians were trapped at water's edge, and the colonists killed "40 to 50" men, women, and children (Wilbarger 1890; Marr 1928). The name Dressing Point was reportedly given by the colonists, remembering the place where the Karankawa were given a "dressing" (Himmel 1999).

There were other smaller skirmishes, but by Autumn 1826, surviving Karankawa sued for peace, meeting Austin and others at Guadalupe Victoria (modern Victoria). The Karankawa Indians agreed to remain west of the Lavaca River, and Austin gave them permission to return briefly to the Austin Colony to bring out remaining Coco in the Colorado-Brazos area. Most then headed south of the Lavaca, seeking to survive along the Nueces River and in South Texas, where not only other Native Americans but also Tejano ranchers already dwelled. That Austin allowed the Karankawa to retrieve the remaining Coco from the Colorado-Brazos area (their homeland) suggests that they may not have taken a strong part in the Karankawas' war. As we have seen, they are usually ranked linguistically and culturally with the Karankawa, but in mission days they often parted company. Available information does not allow us to separate them from the Karankawa in this war of the 1820s, and of course most of the bloody incidents occurred in their home area. It is clear, however, that after 1826, they were expelled alongside the Karankawa.

The situation left any remaining Indians in the area in a very untenable situation. In 1833 a party of Karankawa (probably Coco) approached settler Daniel Gilleland (who lived near Wharton) to demand some corn (Figure 4.22). He refused, and then raised a party of settlers to attack the Indians in their camp, killing several (Wilbarger 1890). The settlers knew that the Karankawans had agreed to leave the area, so felt no need to accommodate the Indians.

Evicted Karankawa of the region headed south along the coast, south of the

Lavaca River, and found more trouble. The survivors began to kill ranchers' cattle on both sides of the Rio Grande, and some number of Tejano ranchers were robbed and murdered. Mary Austin Holley, in her history of Texas published in 1836, recounted the Mexican official response and the sad results for the homeless Indians:

> *Recently, the Mexicans have commenced killing the remnant of this tribe, for some robberies and murders committed by them. The survivors have crossed the La Baca* [heading back north into Austin's forbidden colony]*, to the number of forty or fifty, to beg the protection of the colonists, offering to perform any kind of service or labour, in return for protection and food. The people on that frontier have, accordingly, distributed them amongst their families as servants. Thus the shores and bays of this beautiful region, in which these fierce children of the woods once roamed, free as the lion of the desert, have been transferred to other hands. From being the rightful proprietors of the domain, they have become the hewers of wood and the drawers of water to their invaders.* (Holley 1836)

A party of Texian soldiers was attacked by Karankawas twelve miles east of La Bahía (Goliad) in October 1835, and one of the soldiers was killed (University of Texas at Arlington 2019). The Karankawa position during the Texas Revolution is unclear; Alice Oliver (see below) mentioned that "some Karankawas together with other Indians formed part of the Mexican army, and that after the battle of the Alamo the American settlers retaliated heavily for the crimes committed by them with or without the behest of their Mexican superiors" (Gatschet 1891).

After the war Karankawa survivors in South Texas and northern Mexico again began to plunder local ranchers on both sides of the border. The Reynosa authorities (in Mexico) drove the remainder into Texas in 1858, and according to the judge of the border town of Rosario, "The history of these Indians terminates with an attack made upon them in the said year 1858, by Juan Nepmuceno Cortina, then a citizen of Texas, along with other rancheros, when they were surprised at their hiding place in Texas, and were exterminated" (Gatschet 1891).

Meanwhile, a small group of Karankawa survivors lived peacefully as traditional hunter-gatherers on Tres Palacios Bay at a place called Port Austin (Figure 4.22, bottom center). They were befriended by Alice Williams Oliver, who grew up at Port Austin on her father's farm. Her father was Thomas Bridges, who moved to Texas in 1838. It is from Mrs. Oliver that we know much of Karankawan customs and language. She documented the only words of the now extinct language, and her experiences are recorded extensively by Gatschet (1891). Gatschet, using her observations, noted: "In winter these Indians were in the habit of staying in the woods on the Colorado River and at Caney Creek, because it was warmer there, and there they could gather pecan-nuts and hunt bears [by this time, the bison were extinct in coastal Texas]." They moved on the coast in dugout canoes, and other than their tent poles, skins for bedding, a few cooking pots, and their bows and arrows, they had few possessions. They lived in the same style of rounded huts in which the Akokisa lived, and up to seven or eight people could live within these temporary shelters. Skins and furs were used as floor mats and bedding. They kept dogs.

Women wore only a skirt, and the men only a breechcloth. Oliver noted that they frequently bathed in salt water, as the Talons had seen 150 years earlier, but

that the oil with which they anointed themselves against mosquitoes rendered them "very offensive" in smell. Oliver described their facial tattoos as being small blue circles tattooed over each cheek bone, as shown in Berlandier's drawing of 1830 (Figure 4.5), and a few other parallel lines, including three vertical lines from the chin to the lip. They applied red and black paint to their bodies in the form of animals or human faces.

They were fond of a "tea" made from yaupon, as were other southeastern tribes. They danced to music made with gourd rattles, a notched stick rhythmically rubbed by another stick, and a simple flute; this is very similar to the music of the Akokisa described earlier. Oliver also described their manufacture and use of pottery: globular-based pots that they ornamented on the outside with "black paint." This is an apt description of what archeologists call "Rockport ware," found in Late Prehistoric sites along the central coast, which had an applied decoration of black asphaltum (Ricklis 1996). Gatschet noted that the Karankawa—unlike the Atakapa—did not make baskets or cane mats.

The French scientist Berlandier, who visited the coastal Karankawa at Aransas Bay in 1829, noted their use of bows and arrows in fishing from log canoes:

> *The Carancahueses have many pirogues, and one can see their little fishing fleets moving from one island to the next in search of food. Fishing is their principle occupation and their main diet is fish, augmented with tortoises and alligators which they hunt in the rivers. These island people, since many of them live on the Bay Islands, have a reputation as the most skilled of all savages with the bow and arrow. I have seen them attract fish in their bays and inlets by flailing the water around their pirogues, then use their bows and arrows to shoot the fish that came to the surface.* (Berlandier 1969 [1830])

The Karankawa living near Port Austin were, by the 1840s, a broken people. Of the remnants around Tres Palacios Bay at Port Austin, Alice Oliver said:

> *They were surly in their general aspect, averse to conversation, and the deep gutteral [sound] of their language, as they occasionally talked with each other, always with averted faces, left the impression of extreme fatigue.* (Gatschet 1891)

Their numbers diminished quickly from "consumption and other distempers, and also through frequent brawls caused by intoxication," according to Mrs. Oliver. By the late nineteenth century they were gone. One of the last known survivors was Mary Amarso Pathoff, adopted as a baby by settler James Power in 1841. She married a German immigrant named Charles Pathoff and died in 1911. Her obituary called her "the last known full-blooded Karankawan Native American known to be living in the Coastal Bend at the time of her death" (Himmel 1999).

## Ethnologists on Atakapa and Karankawa language and folklore

By the late nineteenth century, with the foundation in 1879 of the Bureau of American Ethnology, serious academic efforts began in studying various Native American groups in the United States that were nearly everywhere in rapid decline. For the Atakapa and Karankawa, such studies came a bit late, but dedicated eth-

nologists and linguists began to compile and organize what information they could from the last native speakers, or in the case of the extinct Karankawa, those who *knew* the last native speakers. The record the ethnologists and linguists were able to assemble is patchy but still very useful in understanding aspects of how these groups viewed their origins, and how their now extinct languages related to those of surrounding groups in the historical record.

## Atakapa language

The Atakapan language is the extinct tongue of the people of that name living in the southeastern Texas and southwestern Louisiana lowland marshes, swamps, forests, and prairies. The Atakapans were surrounded by neighbors who spoke vastly different tongues, such as the Karankawa along the coast to the southwest; various Tonkawan groups in the less humid plains to the west; the Hasinai, Eyeish, and other Caddoan groups in the forests to the north; and an array of linguistic groups in the Lower Mississippi Valley to the east (Figure 4.1). Efforts by linguists and ethnologists like Swanton (1919) and Haas (1966) to connect the Atakapan language with Lower Mississippi Valley languages like Chitimacha, Natchez, and Tunica have not found general approval (Hopkins 1999). Linguists thus consider the Atakapan language to be an *isolate*, with no close affinity with any known tongue (Mithun 1999; Kaufman 2014).

The isolate status of the language implies that the people who spoke it may have originated separately and distinctly from other groups, perhaps thousands of years earlier. Given that Atakapan territories are in a specialized environment of warm, humid coastal lowland marshes, swamps, and barrier islands that lie within the drainage basins of small river systems sandwiched in between the drainage basins of the much larger Mississippi and Brazos-Colorado rivers (see Figure 4.1 and discussion, Chapter 1), it is tempting to assume as a starting hypothesis that they developed right where they lived when first encountered by Europeans. That hypothesis is in line with the Atakapan creation myth recorded by Dyer (1917) from Louisiana Atakapans, which affirms that the connection they had with the seacoast was longstanding: "They came out of the sea, being cast up in large oyster shells, from which the first men grew."

Gatschet and Swanton (1932) recognized five clearly defined subgroups, or bands, of the Atakapa that are outlined in Figure 4.1. The eastern two, on Vermilion Bayou and along the Mermentau River, spoke an eastern dialect and were known as eastern people (*Hiyekiti Ishak*). It is assumed that another more inland group of which less is known, the Opelousas, also spoke this dialect. An 1802 manuscript of Martin Duralde from Attackapas Post (modern Franklin, Louisiana) contains a vocabulary of 287 words attributed to these people. The western groups were known as *Hikike Ishak*, or western people, which included those living along the Calcasieu River, the Atakapa proper of the Neches-Sabine area, and the Akokisa and Bidai. Ethnologist Albert Gatschet recorded speakers in Lake Charles (along the Calcasieu River) in 1885 and prepared, with Swanton, a dictionary of the western Atakapa language (Gatschet and Swanton 1932).

The term Akokisa is a French corruption of *Hikike Ishak* that came to be applied

to the Atakapans around Galveston Bay by the Spanish (the Spanish pronunciation of the term being *Orcoquisac*). That the Akokisa spoke the western dialect is known from the work of Jean Béranger was the captain of the French ship *Subtile* that was sent with an expedition led by Bénard de la Harpe to explore Galveston Bay. Simars de Bellisle, fresh back from his adventures in Galveston Bay of 1718 with the Akokisa, was on that voyage. Several Akokisa were taken captive, and from them Béranger recorded 45 words, enough from Gatschet and Swanton to conclude that the Akokisa spoke the western dialect of Atakapa language. The Bidai language was never recorded, but from Spanish records it is clear that they and the Akokisa shared a common language (Bolton 1970 [1915]), a conclusion accepted by Gatschet and Swanton.

In preparing their vocabulary, Gatschet and Swanton recorded the words of several native speakers who added to our knowledge of these people. We find that they were mostly monogamous, and that they did not marry relatives; in small groups that meant that they married outside the band, which made for culturally fluid boundaries with neighboring groups. One speaker mentioned religion:

> *The [Atakapa] prayed standing to One-above. They danced the sacred dance to One-above. They also danced the young people's dance and the old people's dance…. They danced painted with red and white paint and, when relatives had died, with black paint and with feathers on their heads, sounding a rattle at the dancing place.*

Of particular interest is the following piece of Atakapan folklore collected by Swanton, which suggested that the use of fire in hunting, noted at length above, is deeply entrenched in their folklore:

> *A favorite story of both the Chitimacha and Attakapa (sic) tells how a person once became angry with everybody and set the sea marshes on fire, intending to destroy them. A little bird flew up into a tree and shouted, "Kū'naxmiwica! Kū'naxmiwica!" ("The water and all is going to burn!") …. When people saw the marshes burning they ran down and killed all kinds of game which had been driven from cover by [the fire]. Then they said of the ill-disposed man: "Now that you have put fire in those tall weeds, deer, bear, and all kinds of animals have come out, and we have killed more than we can use. You have benefited us by burning them."* (Swanton 1907)

### Karankawan language

The Karankawan language was extinct by the time ethnologist Albert Gatschet arrived on the scene in the late nineteenth century, but he met several people who, in their youth, had spent considerable time with the last Karankawa groups. The most extensive knowledge came from Alice Oliver, who as mentioned above spent time with them and learned Karankawan speech in the early 1840s as a girl at Port Austin on Tres Palacios Bay (Location 34, Figure 4.10). From these sources he produced a list of a few hundred words as well as a study of pronunciation, syntax and grammar. It is likely that the Karankawa survivors there included some Coco, as we know that Coco merged with other Karankawa after the 1826 treaty agreement reached in Victoria between the vanquished Karankawa and Austin's colonists.

Gatschet compared the Karankawan language learned from Oliver and others with the Tonkawa language and three dialects of Pakawa, a Coahuiltecan language and concluded that the Karankawan language, too, was an isolate: "…the idioms are so unintelligible to each other that the Indians of none of these three languages could have entertained the idea that all came from a common stock (Gatschet 1891)."

He then compared Karankawa with a number of other Gulf Coast languages, including Caddo, Atakapa, Tunican, Natchez, and Chitimacha, expecting to find similarities – but found few. Like the Atakapa, the Karankawa lived in a coastal area of marshes, small rivers and barrier islands – a unique environment relative to the vast Texas plains and savannahs to its west. Again, it is reasonable to think that the Karankawa developed, more or less, where they lived in historical times. Mithun (1999) concurs with Gatschet and classifies the language as an isolate.

### Isolate coastal languages and cultural origins

Native American languages are generally much more distinct from each other than are European languages, and the isolates – such as Atakapan and Karankawan – are the most distinctive. Consider the words for numbers. Because these are among the most basic words in a language, they tend to unmask common origins. In the eastern hemisphere on the European continent, words for the term "three" are strikingly similar, no matter whether expressed in Germanic, Celtic, Mediterranean, Scandinavian or Slavic tongues, even though these groups have strikingly different ethnic origins (see adjacent table, Figure 4.23). This is so because Europe has a history going back thousands of years of conquest and reconquest. In the western hemisphere, Native American languages show that trait of similarity much less frequently, as evidenced by the extreme dissimilarity in the words for "three" among peoples of the Texas-Louisiana region. As Gatschet put it,

> *When the language of a people is shown to pertain to a certain family, this does not always determine the ethnic race to which it belongs; but in [the] western hemisphere it does so in most instances, because here the nations which are known to have exchanged their paternal language for that of other national bodies by conquest, commercial intercourse or other contact are by no means as numerous as in the eastern hemisphere.* (Gatschet 1891)

The ecoregion inhabited by the Atakapa (and for that matter, the Karankawa) – the swamps, bayous and barrier islands near the lowland coast – is vastly different than that of the central and north Texas plains. Although lush with vegetation and animal life, surviving in that humid, semi-tropical environment takes a different skill set: fishing, shellfishing and catching alligator instead of (mostly) bison hunting on the plains, for example, or the constant use of alligator oil to repel mosquitoes. It may have been enough of an acquired taste that the Atakapa and Karakawa, including the Coco, were mostly left alone, except at their borders.

Figure 4.23. The word "three" expressed in various European and western Gulf Coast languages.

**The Word "Three"**

| EUROPEAN LANGUAGES | | WESTERN GULF COAST LANGUAGES | |
|---|---|---|---|
| English | Three | Atakapa | Lāt |
| French | Trois | Karankawa | Kaxáyi |
| German | Drei | Tonkawa | Metis |
| Spanish | Tres | Caddo | Daháw' |
| Gaelic | Trì | Natchez | Ne-ti |
| Norwegian | Tre | Chitimacha | Kahitie |
| Greek | τρία | | |
| Russian | три | | |

## Summary

From the above accounts, a fairly clear picture emerges of the Atakapan (proper), Akokisa, and Bidai, as well as the Karankawa, but a somewhat less clear picture of the enigmatic Coco.

**Territory.** The Bidai (Figure 4.4) lived primarily along the Trinity north of the modern town of Livingston (Aten 1983) but maintained hunting winter camps along the west flank of the Pineywoods forest in the Grimes and adjacent prairies, at the western edge of the San Jacinto and Trinity River basins. The Akokisa lived along the coast surrounding Galveston Bay, principally at the mouths of the San Jacinto and Trinity Rivers, but like the Bidai migrated inland to the prairies (specifically, the Katy Prairie) in fall and winter for hunting bison and deer.

The Atakapa band lived along the lower Neches, and it is not known to what extent, if any, they may have migrated inland for fall and winter hunting. However, the Atakapa of southwest Louisiana are known to have migrated northward in the Fall to hunt bison that were seasonally migrating south.

The Coco lived primarily along the coastal portions of the Colorado and Brazos valley, but were known to migrate far inland for fall hunting, with or without their presumed kin, the Karankawa.

**Living.** All of these coastal groups lived in bison hide-covered domal tents, the supports for which were made of green sticks lashed together. With this type of dwelling, they could easily move, taking the hides with them. All of these groups built and used dugout canoes. The Bidai and Atakapa were skilled basketmakers who used split cane. Bidai dwellings seen by Rubí's men in 1772 contained furniture of woven cane and palm fiber that the Spaniards deemed of excellent quality. The Karankawa and Atakpapa valued music and dance, and played rhythmic instruments.

Karankawa were clean in their personal habits, bathing every morning regardless of weather, but their use of alligator oils to repel mosquitoes gave them an odor that was repulsive to Europeans. All the coastal groups wore similar clothing, consisting only of breechcloths for men and skin skirts for women. Tatoos on the face and body were used by all these coastal groups.

The Atakapa bartered for wives with other groups outside of their bands, which no doubt fostered inter-tribal communication.

**Leadership**. The various Bidai and Akokisan chiefs cooperated with each other, but there appears to have been no over-arching tribal leader, even at the band level. During the contest for supremacy between the French and Spanish in East Texas, Akokisa chiefs of three villages were split in their allegiances (Bolton 1970 [1915]).

**Diet and fishing**. The Akokisan, Bidai and Karankawan diets were heavy on fish, supplemented by deer and (in the west) bison. They were skilled in use of dugout canoes. They caught fish with harpoons, spears, and with weirs. They traded dried fish and other marine products with inland groups.

They gathered oysters with rakes, baked them in the fire, and made large middens of the shell remains. They typically did not bury their dead in these middens, at least when recorded in historic time, but high ranking tribal members were able to place their homes on them.

When living in swamp country, they caught alligators by the snout and dragged them on the bank to kill them, or they speared alligators in their eye sockets. From alligators they obtained not only food but essential oils used as skin ointments to repel mosquitoes and to ward off sunburn.

They ate persimmons, "wild sweet potatoes," pecans and other nuts and fruits from the forest, and made a sort of bread from tubers.

**Hunting techniques**. All these coastal groups participated in group (communal) hunting of deer and bison. Fire was extensively used over large areas, not only to drive game but to coax game into certain areas by providing new tender green shoots that grew after fires had cleared the prairie. Fire use in hunting was noted by several observers over different periods of time, and was ingrained enough to work its way into Atakapa folklore. Bison hunting occurred along the coast at Matagorda Bay, but the key hunting grounds – established by multiple observances – were in the Katy, San Bernard, and (for the Bidai) Grimes prairies.

In days before the horse, communal hunts used either surround-and-tighten methods or the driving of the game over low bluffs into waterways, where the game were slowed and slaughtered. After the horse appeared (by at least 1718 but perhaps earlier), and bow and arrow technology arrived, bison hunting methods changed.

**Farming**. The Akokisa at Calzones Colorado's village on the lower Trinity were beginning to experiment with corn by 1748 (Miranda called it "superfine maize" in 1756), but in a way that Orobio Basterra observed in 1748 was small. The Bidai also raised corn to supplement their diets (Sjoberg, 1951). Corn was grown extensively by the Caddo tribes to the north of the Bidai, and the use of it by Bidai reflects Caddoan influence on the northern edge of Atakapan territory. The Karankawa are not known to have practiced any sort of farming.

**Language.** The isolate nature of Atakapan and Karankawan tongues evoke centuries if not millennia of linguistic isolation, suggesting that geographic boundaries with other surrounding cultural groups, which in AD 1700 mostly occurred at drainage basin boundaries, were also static. The exception for this was the boundary with the Caddo, which appears to have been migrating southward during the last thousand years (see discussion, Chapter 11).

**Population.** Population numbers for all Southeast Texas groups were in rapid decline during the Spanish period as a result of epidemic diseases. For example, Orobio Basterra, in 1748, counted about 1200 Akokisa in 300 families, but Miranda's notes of 1756 indicate only about 500-600 persons. An estimate in 1778 put the Akokisa warrior count at only about 50 (and hence, the total count at perhaps 200; Bolton 1970 [1915]). By the middle of the nineteenth century, all these groups were organizationally extinct, although small numbers of individuals and families survived and ultimately melted away into the larger coastal population.

With these data from the Historical Period established, we can add more interpretive color to an archeological record that consists largely of observations and analysis of artifacts of stone, bone, ceramics, and charcoal found in ancient refuse piles and burial grounds.

# 5.

# Archeological database and geographic information system

A large number of archeological studies of the Southeast Texas area have been done over the past 60 or more years. The factual data from those reports, when entered into digital databases, can be linked with modern geographic information systems in order to view the varied aspects of this area's human prehistory in temporal and landscape contexts.

## A Brief History of Archeological Research in Southeast Texas

The first significant archeological study in Southeast Texas was done by Joe Ben Wheat, who excavated several sites in the area of the modern Barker and Addicks reservoirs of western Harris County in 1947. His work established the relative chronology of the area and demonstrated that Native American prehistory here stretched as far back in time as anywhere then known in the United States (Wheat 1953). In the 1960s a number of professional site studies were done in the Houston area by the Texas Archeological Salvage Project (now the Texas Archeological Research Laboratory, in Austin).

In 1959 the Houston Archeological Society (HAS) was founded, and by the 1960s Lawrence Aten and members of that organization had excavated a number of coastal midden sites. A 1983 synthesis by Aten, *Indians of the Upper Texas Coast*, summarized that period of work and remains a standard reference for the archeology of the coastal region as well as for the classification and chronology of ceramic

technology in Southeast Texas. The society publishes the only journal devoted to the archeology of the region.

In the 1970s and 1980s a number of studies were undertaken by Texas A&M University in the region, including a key study of a hunting site on White Oak Bayou in Harris County (Ensor and Carlson 1991). A Texas Archeological Survey (University of Texas at Austin) study by Hall (1981) at Allens Creek established a Late Archaic mortuary tradition along inland Brazos River and brought to light a number of exotic trade artifacts that demonstrate long distance exchange of goods (Chapter 11). Dee Ann Story (1990) prepared an archeological synthesis of the northwest Gulf Coastal plain, including Southeast and northeast Texas as well as parts of southwest Arkansas, southeastern Oklahoma, and northwestern Louisiana, as part of an Arkansas Archeological Survey study for the U.S. Army Corps of Engineers. It is a detailed standard reference not just for Southeast Texas but for surrounding areas. Also during this same period, a large body of site work was done by contract archeological firms in the form of Cultural Resource Management studies. These firms have included Prewitt and Associates; Coastal Environments; Espy, Huston and Associates; and Moore Archeological Consulting. A dissertation by Moore (1995) presented a regional model of Mossy Grove (Ceramic and Late Prehistoric Periods) culture in the San Jacinto River basin.

Meanwhile, numerous site studies were done by HAS in the late 1970s through early 2000s of inland and coastal regions. Much of this archeological site information was entered into a digital database in the late 1980s by Leland Patterson (1929-2017; Figure 5.1), who at that time was the head of the Houston Archeological Society (HAS). He kept the database up to date until 1996. That year Patterson published a synthesis entitled *Southeast Texas Archeology* (Patterson 1996), which remains the most complete reference for the archeology of the area. The work has extensive summaries of data from sites regarding lithic points and tools, faunal and floral information, ceramics, radiometric data, and the like, as well as interpretations of lifeway zones and social organization. The work is thorough and groundbreaking for the Southeast Texas area.

Figure 5.1. Leland W. Patterson (1929–2017), former president of the Houston Archeological Society, at an excavation site in the San Bernard Prairie, ca. 1989. Photo courtesy of Gary Ryman.

Key HAS work in the 21st century has included a major study with the Texas Department of Transportation (TxDOT) of Dimond Knoll on western Cypress Creek, studies of Clovis artifacts from the Wood Springs and Timber Fawn sites in Liberty and eastern Harris counties (Crook 2017a, 2017b; Crook et al. 2016), and a syntheses of the Kyle Collection, a significant group of artifacts from Liberty and surrounding counties (Crook et al. 2017). Bibliographies of Southeast Texas archeology, including the many reports of the Houston Archeological Society, have been prepared by Patterson (2005a) and, more recently, by Moore (2015). As a result of all this previous work, impressive amounts of archeological data exist in this region, in large part deriving from the most active avocational archeological society in the state.

## The project's digital archeological database

This project's digital database of archeological data is based upon the above-mentioned digital database originally prepared in the 1980s by Patterson. This database covers published archeological sites in an eighteen-county area of Southeast Texas (Figure 5.2) and constitutes the largest single repository of primary site data on the archeology of this region. When first published in 1989, it consisted of two digital databases: *A Data Base for Inland Southeast Texas Archeology*, and *An Archeological Data Base for the Southeastern Texas Coastal Margin* (Patterson 1989a, 1989b). These two digital databases are organized in flat files, including general location information as well as information on lithic projectile points and tools, faunal and floral remains, ceramic types, burial data, and radiometric dates. Detailed site locations were withheld from published versions. He updated both databases in 1996.

The contents of Patterson's databases were drawn primarily from publications of the Houston Archeological Society, which detail the results of hundreds of site investigations of the Southeast Texas region dating from 1959 to the present. Nearly all the HAS reports are digitally available on the society's website (www.txhas.org). It is a tribute to Patterson's legacy that he either led or actively participated in a large percentage of the reports in the database; it is a record of avocational activity that is perhaps unexcelled elsewhere in the state. The database also includes results of archeological studies by other academic and professional groups, where published. It does not generally include information from unpublished site records of the Texas Archeological Site Atlas of the Texas Archeological Research Laboratory, as those records primarily consist of site location documentation. However, the trinomial site designations of that Atlas are used for the designation of all HAS and other

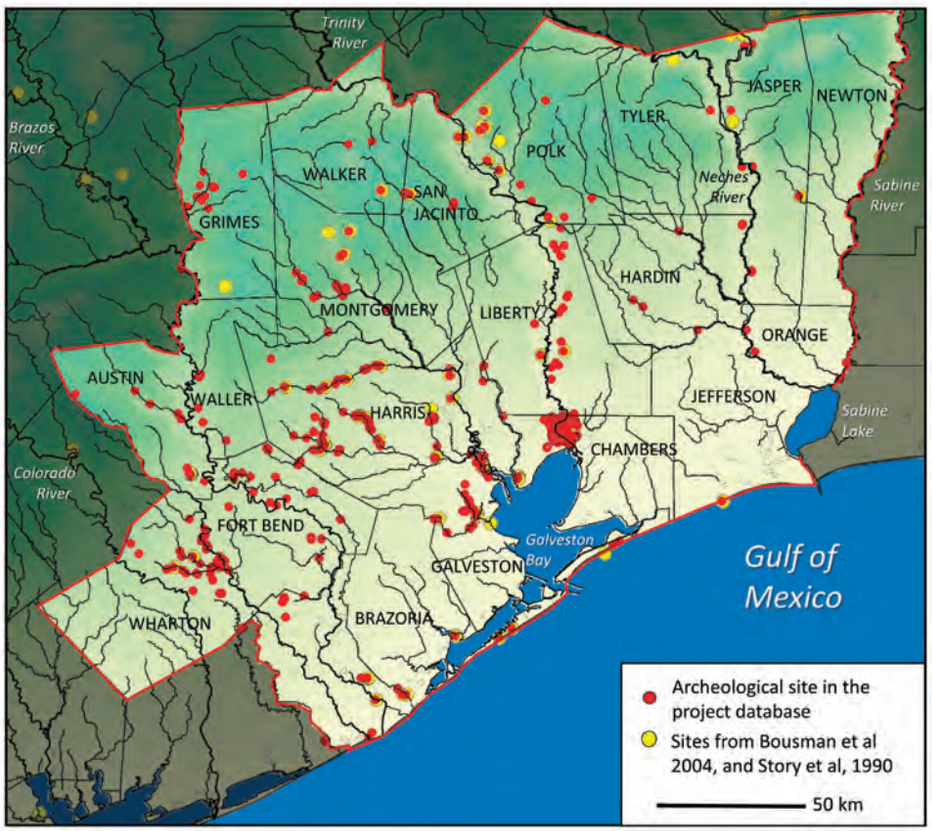



Figure 5.2. Location of the project database (red outline) and its archeological sites (red circles), updated to 2019. Also shown, in yellow, are var-ious sites with archeological data excerpted from studies by Story (1990) and Bousman and others (2004). Counties are named in capital letters.

published sites (as explained later). Site information from Cultural Resource Management studies and other contract studies by professional archeologists is included only where the results are published or generally available.

A first attempt to synthesize the prehistory of the area using the full breadth and depth of HAS studies, including the digital database, was made by Patterson (1996) in his report, *Southeast Texas Archeology*. This report drew from the findings all published HAS and other site investigations of this region, including descriptions of artifacts from surface collections, shovel tests, and in many cases detailed excavations. Although rich in data and interpretive text, Patterson's synthesis is lean on geographic and landscape context. Nonetheless, his digital databases laid the groundwork for the map-based GIS synthesis in the present study.

After Patterson's 1996 synthesis was published, the digital database that was the foundation for his compilation lay fallow and was all but forgotten. Fortunately, a digital copy, albeit in a now defunct software format, was saved by archeologist Roger Moore, who made it available to HAS and to the author of the present work for further use. The two 1995-updated databases were then modernized to Excel format and combined into one project database. Its contents were updated with data from all available HAS studies from 1997 through 2019; the database now includes data from 537 archeological sites. In addition, site data relating to the earlier East Texas studies by Story (1990) as well as information on regional Paleoindian sites compiled and published by Bousman and others (2004) were added to a separate digital database of 278 sites for the eastern half of Texas. Both data sets have been used in the present report (Figure 5.2). The intent is that the new project database, now containing geographic locational data, will ultimately reside with the Texas Archeological Research Laboratory in Austin as well as with the Houston Archeological Society, for their preservation, potential "evergreen" updating, and continued use.

### Database design

The organization of the digital archeological database for the current project reflects Patterson's design and is a compilation of separate flat files containing the following subject areas:

1) Basic site data: Site trinomials and location coordinates (latitude/longitude). The standard state trinomial designation is used for locating all archeological sites. Site labels—for example, site 41HR796—contain three parts: a state code (41 for Texas), a county abbreviation (e.g., HR for Harris County), and a unique site number (796).
2) Arrow points: presence or absence of 14 different arrow point types.
3) Dart points: presence or absence of 33 different dart point types and shape qualifiers.
4) Ceramics: presence or absence of 12 types of ceramics, with counts of sherds.
5) Radiocarbon dates for individual sites; these have not been compiled past 1996.
6) Patterson's summary interpretations of archeological periods represented at each site. These designations are mostly based upon lithic chronology, at times bolstered with radiometric data; see further discussion later.

7) Lithic tools: presence or absence, and in many cases counts, for 11 types of lithic tools, such as gravers, scrapers, perforators, and the like.
8) General lithics: presence, absence and in some cases counts of items related to manufacture of lithic tools, such as large and small flakes, blade and general cores, presence of heat treating, exotic chert, hammerstones, and chert cobbles.
9) Miscellaneous artifacts: presence, absence, and in some cases counts of ten types of miscellaneous artifacts, including clayballs, hearths, red ochre, asphalt, manos, metates, shell and bone tools, etc.
10) Mortuary data: presence or absence of various characteristics of burials, including numbers of burials, grave goods, orientation of bodies, indications of violent death, etc. This data has not been kept up to date beyond initial publication in 1989.
11) Terrestrial faunal remains: presence or absence of 15 types of terrestrial vertebrates.
12) Aquatic faunal remains: presence or absence of 16 types of aquatic vertebrates and shellfish.

## Linkage to a Geographic Information System (GIS)

From this project's inception, the goal has been to tie archeological data to the series of paleogeographic maps developed in Chapter 2 as well as to the restored landscape ecoregions map developed in Chapter 3. This unified database is hereafter termed the "project database." This task was accomplished using ArcMap v.10.7.1, a geographic information system (GIS) software developed by the Environmental Research Systems Institute in Redlands, California. A project area was defined, and then basic geographic data (rivers, roads, counties, and topography) were imported. In addition, a number of published maps were "georeferenced," meaning that they were digitally scanned and entered as locational data. The main maps produced in Chapters 2 and 3 were also georeferenced and entered. Each flat file of the project archeological database was connected to these various maps, so that temporal, locational and numeric data from the updated Patterson-HAS archeological database could be examined in geographic space.

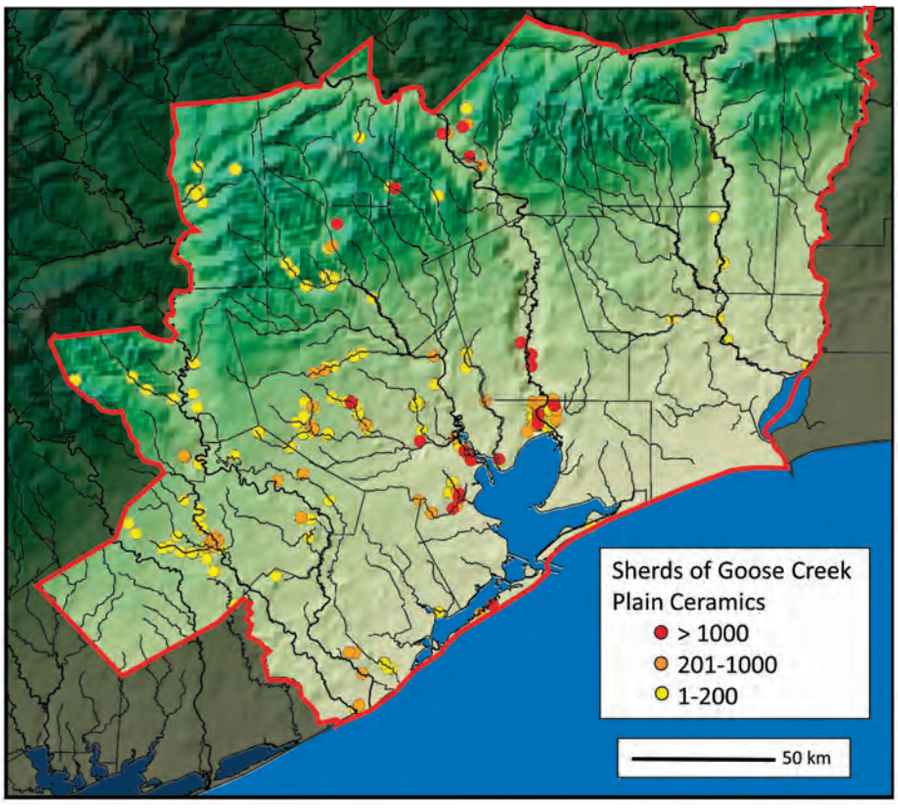



Figure 5.3. Ceramic sherds of the style "Goose Creek Plain" at archeological sites, by numbers of sherds.

An example of such use of the archeological database is shown in Figure 5.3. The

project database includes counts of sherds of various ceramic types found at each site. The most commonly found type was Goose Creek Plain (see Chapter 6), and its sherds are color-coded on the map by frequency of occurrence at archeological sites. The data are plotted on a base map (here, shaded topography with rivers and county boundaries), and the map can then be interpreted in geographical space. It would appear that larger numbers of sherds are found at sites near the coast along Galveston Bay, where Akokisa villages were found in historical times, as well as inland on the Trinity River in the north of the area, where Bidai villages were found in historical times. This suggests that most ceramics were fabricated at these particular coastal and Trinity River sites, and then carried as pots to most inland sites; such was the conclusion of Patterson (1996). Seeing the data plotted geographically is a great assist, both in interpreting the data and in reporting the interpretation, and also allows a researcher to zero in on data outliers, which often have an interesting story of their own to tell.

## Chronology

A basic task of every archeological study is to ascertain the time of occupancy of a site. Archeologists use two main methods to establish the ages of artifacts found at sites. *Relative ages* can be found by observing the relative stratigraphic positions of items found at a well-layered midden. For example, if a Carrollton projectile point is found stratigraphically above a San Patrice point, then it is assumed that the Carrollton point is younger. If at another site a Carrollton point is found overlain by a Perdiz point, then it is assumed that the Perdiz is younger than both the Carrollton and the San Patrice, even though the San Patrice may not be present at the second site; this is an application of the well-known geologic Law of Superposition. In such a way archeologists have assembled networks of site information allowing them to project relative ages of points in an area or region.

*Absolute ages* involve placing an age of formation on a particular artifact or mineral sample that is largely independent of its stratigraphic position. Radiocarbon dating of carbon-bearing artifacts—primarily bone, wood, and shell—has been employed in archeology since the late 1940s, principally for artifacts that are younger than about 50,000 years of age (Mook and Waterbolk 1985). A lithic projectile point is not datable by such means, but if it is found embedded in a bison bone, or if it is found associated with charcoal in a burned rock midden, then it can be dated by association with the carbon-bearing material. In the last decade the technique of optically stimulated luminescence (OSL) has been developed and applied to archeological sites (Rhodes 2011). It is a process of dating geologic sediments (chiefly sand grains) by subjecting the minerals to ionizing radiation and then measuring their luminescence. The amount of luminescence stimulated has been calibrated to the amount of time since the buried material has last been radiated by the sun. These two absolute dating methods are nicely complementary at many sites, as they date both organic (radiocarbon) and inorganic (OSL) materials.

### Lithic chronology

The primary method used in this report to estimate the age of archeological sites is

a chronology of the relative ages of lithic projectile points found at these sites, tied wherever possible to absolute existing radiocarbon dates. Over the decades, in site studies across Texas and adjacent states, projectile points have been named and classified based not only on their shape and manufacturing details but also on their geographic and temporal distribution, allowing them to be used as approximate "time markers" in their home region (Turner et al. 2011). Projectile points are of two basic types: dart points, used to tip cane or wooden darts thrown by an atlatl, and arrow points that tip arrows shot by bows. Dart points tend to be larger and heavier, and were ultimately nearly completely replaced by bow and arrow technology, which reached Galveston Bay around AD 600 (Aten 1983). Drawings of most of the major point types found in Southeast Texas are shown in Figure 5.4 (Paleoindian through Middle Archaic Periods) and Figure 5.5 (Middle Archaic through Late Prehistoric Periods). The drawings are all by Leland Patterson and were compiled from various HAS reports. Four of the points shown in Figure 5.5 are arrow points (Perdiz, Catahoula, Scallorn, and Alba); all the rest are dart points. These point types are all widely recognized in Texas archeology (e.g., Prewitt 1981, 1995; Turner et al. 2011).

Patterson prepared a relative chronology for Southeast Texas for his 1996 report by comparing site stratigraphic and projectile point data from various sites of this region. He then assigned absolute ages for certain points or groups of points where radiocarbon dates of adjacent materials were available. That process may sound straightforward, but in practice it is difficult at best. Many if not most sites in Southeast Texas are not well stratified; some are heavily burrowed by voles and other small mammals, and at other sites lithic points were collected only at the surface, their enclosing soil material having been eroded away. In addition, available associated carbon material for radiocarbon dating is usually in short supply owing to the humid, acidic nature of southeastern soils, which leaches away wood and bone. Nonetheless, Patterson assembled a basic chronology for Southeast Texas (Figure 5.6) that built upon earlier work by Story (1990) and Aten (1983). Projectile point types are listed along the bottom of that figure and are placed in a rough temporal order by a more or less standard sequence of archeological periods that are typically of 1000 to 3000 years duration. Archeological sites in Patterson's original digital database were assigned temporal ages based upon this chronologic chart. The blocky pattern and approximate temporal duration of the various projectile points on that chart reflect the general understanding of point chronology in the 1980s and early 1990s. That general understanding has been considerably refined in the intervening quarter century, as discussed later.

### Time scales for archeological sequences

The archeological *periods* shown in the column on the left in Figure 5.6 (Early Paleoindian through Historic periods) are attached to a time scale in both calibrated years before present (BP) and radiocarbon years BP. These time periods are important for communication among archeologists in various regions of Texas and surrounding states, and yet their temporal boundaries and terminology differ markedly from area to area. As shown in Figure 5.7, accepted sequences of periods for Louisiana and Northeast Texas are significantly different from those of Southeast Texas

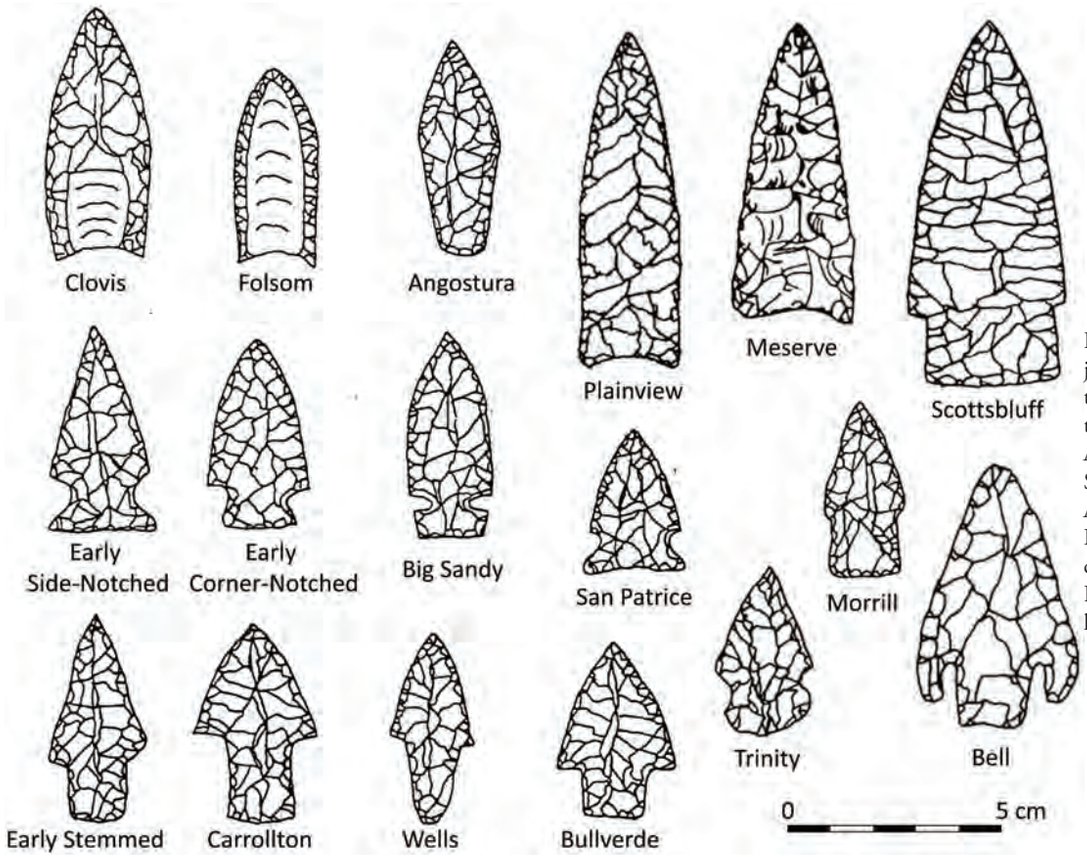



Figure 5.4. Projectile points of the Paleoindian through Middle Archaic Periods of Southeast Texas. All drawings are by Leland Patterson, courtesy of the Houston Archeological Society.

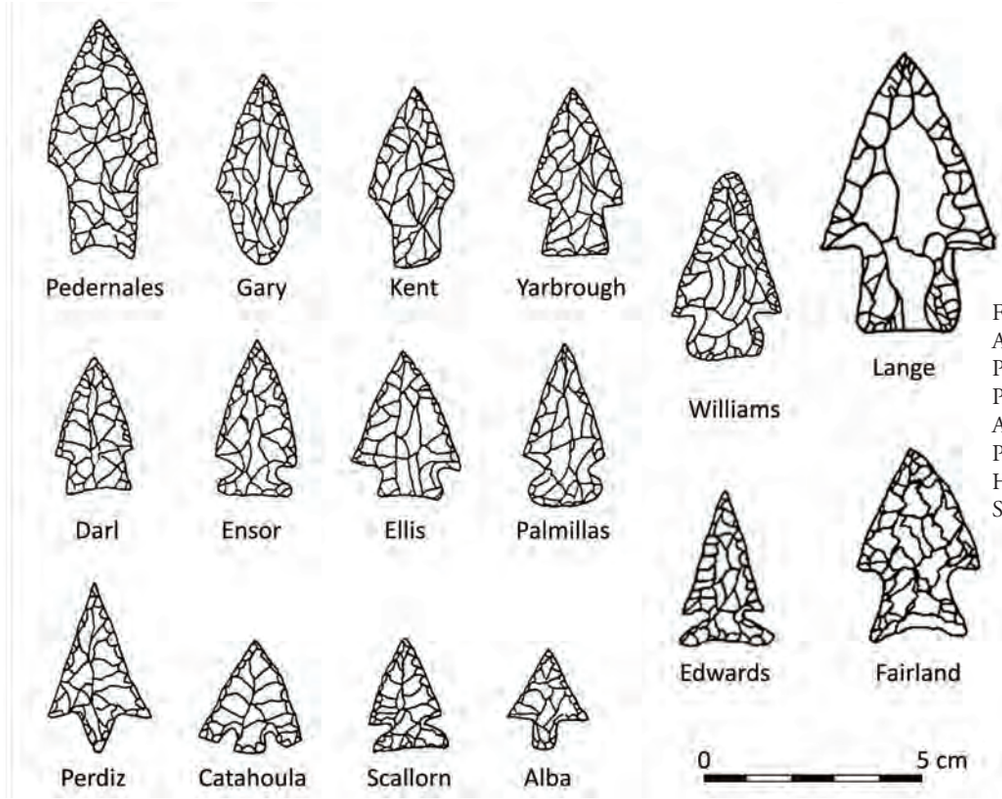



Figure 5.5. Middle Archaic through Late Prehistoric Projectile Points of Southeast Texas. All drawings are by Leland Patterson, courtesy of the Houston Archeological Society.

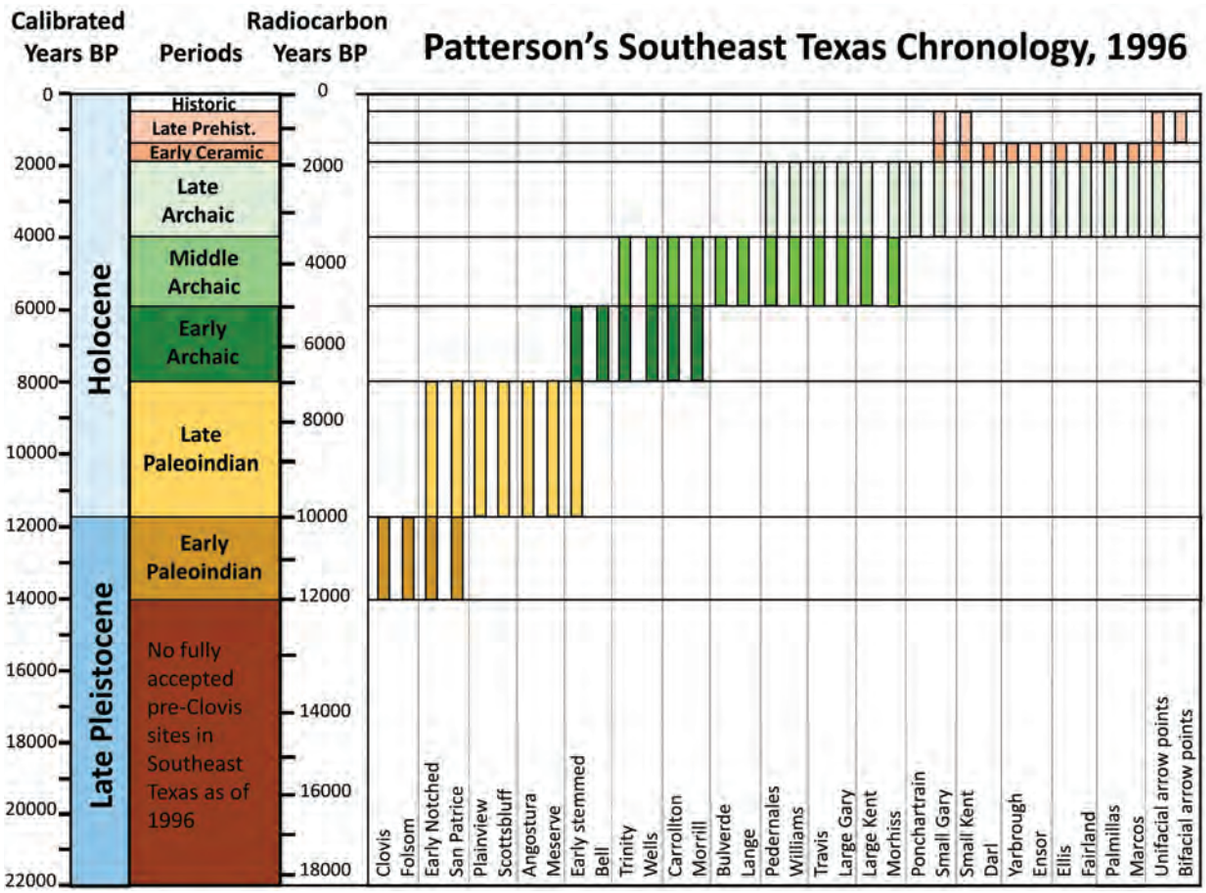



Figure 5.6. Leland Patterson's projectile point chronology from his 1996 HAS report, *Southeast Texas Archeology*.

(shown both as Patterson's 1996 version, column 3, and that used in the present report, column 4), and those of Central Texas (from Prewitt [2017], column 5, and Collins [1995, 2004], column 6). For example, the time period assigned to the Early Archaic in Louisiana (column 1) or in Northeast Texas (column 2) is not close to that of the Early Archaic in Central or Southeast Texas. Moreover, the younger zone of the sequences varies even more dramatically. In Louisiana and Northeast Texas there is a "Woodland Period" partly corresponding to an "Early Ceramic" Period in Southeast Texas, and neither is present in Central Texas. These different sequences largely represent differences in the histories and makeup of diverse cultures of the various regions, but they also perhaps reflect ambiguities and subjectivity in usages of old archeological terms and concepts.

Making sense of these differences—all are valid representations of local archeology—one must consider the origins of sequences and time scales in North American archeology. Before the widespread use of radiocarbon dating began in the 1950s, there was no reliable way to assign an age in years to most artifacts or sites. Instead, archeologists spoke of "stages" of cultural manifestations, or of inferred social development. A basic sequence of cultural stages of development for North American prehistory was advanced by Willey and Phillips (1957) in their classic treatise of archeology. It set out five large developmental stages, thought to represent a general path in human cultural history from relatively primitive behavior to civilization, reflecting the general state of archeological understanding at that time. The earliest of Willey and Phillips's original North American stages was the *Lithic stage*, defined as one of "roaming" big game hunters, who were generally rootless and who

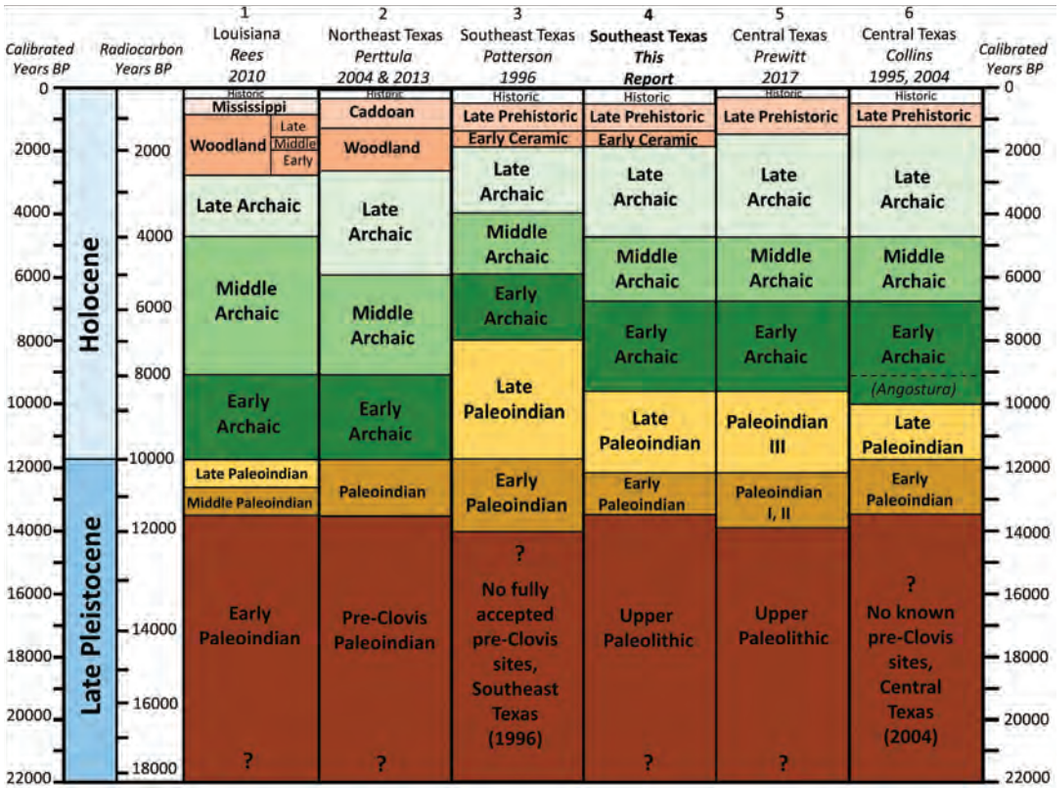



Figure 5.7. Comparative chronological charts from selected reports for Southeast Texas and surrounding regions in Texas and Louisiana.

scoured whole regions for prey. This stage would include in its earliest portion the people associated with the Clovis and Folsom lithic traditions. In Texas this stage is typically termed the *Paleoindian stage*, following Prewitt 1981a.

Next was an *Archaic stage*, typically defined by Willey and Phillips as a time of hunter-gatherers, but with intensified gathering of wild food resources from their local environments, implying the beginnings of a more sedentary lifestyle. In the usage of Suhm and others (1954), the Archaic "bridges the time between Paleo-American [Paleoindian] nomadic hunting people on the one hand, and the settled agricultural, pottery-making Indians on the other." Then came a *Formative stage,* originally "by the presence of maize and/or manioc agriculture and by the successful socioeconomic integration of such an agriculture into well-established sedentary village life." Here an obvious difficulty arose in the Louisiana and Lower Mississippi Valley, where mound builders were active whose work signified a more organized and at least partly sedentary community, but these people were still hunter-gatherers. The term Woodland Period was largely devised to address this discrepancy (e.g., column 1, Figure 5.7). People of the Tchefuncte, Marksville, Troyville, and Coles Creek cultures—all successive mound builders of Louisiana Woodland culture—were hunter-gatherers, and maize cultivation came about in large measure only in the post-Woodland Mississippi Period (Rees 2010b).

Willey and Phillips's last two stages, *Classic* and *Post-Classic*, are defined as linked with qualitatively defined "excellence in the great arts, climax in religious architecture, and general fluorescence in material culture," plus "the beginning of urbanism." In the Lower Mississippi Valley, people of the Mississippian and Plaquemine cultures used agriculture and demonstrated great achievement in art, architecture, and urban centers; Mesoamerican examples would include the Maya and

Toltec cultures. The Willey and Phillips classification scheme had an overall conceptual underpinning of the progress of both time and "civilization." Such elegance in large-scale urban design and agriculture was not visited upon the cultures of Southeast Texas, but Aten (1983) and Patterson (1996) used an "Early Ceramic Period" to indicate that at least ceramic technology had arrived. In like fashion, in Southeast and Central Texas, a "Late Prehistoric Period" is used to indicate that bow and arrow technology had arrived. Usage of such technologies in Texas cultures may not rise to the level of Classic and Post-Classic civilization as envisaged by Willey and Phillips, but they were nonetheless powerful agents of change in hunter-gatherer societies.

Other developments have raised questions about the boundary between the Paleoindian and Archaic stages. Until relatively recently there were no known (or at least, no generally accepted) pre-Clovis artifacts in Texas, but that situation has changed greatly with the study of abundant pre-Clovis remains at the Gault and Friedkin archeological sites in Bell County (Williams et al. 2018; Waters et al. 2011, 2018), of which more later, and at many other sites in North and South America (e.g., Suárez and Ardelean 2019). As those studies accumulated, it also became clear that the early concept of iconic roaming hunters of big game (including the hunting of Pleistocene megafauna) was an oversimplification of a much more diverse situation for early Native Americans. As Perttula (2004) has stated, "The simple cultural sequence of big game hunting "cultures" . . . is no longer adequate to accommodate the diverse material cultures, projectile point styles, and indicated subsistence behaviors now documented during what has been traditionally recognized as the Paleoindian period." With increasing study, the cultures of people who used tools like Folsom, Plainview and other Paleoindian points can be shown to have been partly sedentary, or at least they included hunters who restricted themselves to certain regions, as opposed to being widely ranging, relatively rootless bands (see discussion, Chapters 7 and 9). If Paleoindian people were partly sedentary (and may already have been using plant materials as part of their diets), then how does one define the beginning of the Archaic stage? The situation all gets somewhat subjective, and may be at the root of the obvious differences in the times of the beginning of the Archaic seen in Figure 5.7. The differences can be partly explained away by noting different paces of social development in different areas; but then all of eastern North American appears to have hosted Clovis material culture, and hence saw early, partly "sedentary" behavior.

As radiometric dating emerged into widespread usage, reasonably firm ages could be assigned to events in the archeological record. Where chronologies for specific regions once contained Paleoindian (or Paleo-American) and Archaic *stages* (e.g., Suhm et al. 1954, or Prewitt 1981a), today they are more typically labelled as Paleoindian and Archaic *periods* (e.g., Ensor and Carlson 1991; Patterson 1996; Turner et al. 2011). This signifies a subtle but apparent shift from using concepts of social development to help indicate relative time to the use of radiocarbon and OSL dating techniques to define absolute time intervals. The older terms have mostly been kept, and contain some internal conceptual discrepancies if one delves too deeply, but the emphasis now seems to be on the temporal boundaries more than the names themselves. Hence, when Patterson subdivided the Archaic into Early, Mid-

dle, and Late Archaic periods, it was done more or less arbitrarily, and the resulting subdivided Archaic sequence was not particularly reflective of defined changes in social development. Patterson (1996) did not see the utility of developmental stages as chronological indicators in Southeast Texas, because as he observed, "a nomadic hunting and gathering lifeway was practiced throughout *all* prehistoric time periods in this region" (emphasis added).

The time sequence used in this project for Southeast Texas—the fourth column in Figure 5.7—like all such regional chronologies, is a compromise between earlier chronologies focused on cultural development, one the one hand, and, on the other, a purely temporal sequence based upon groups of lithic points tied to radiocarbon dates. Starting at the bottom, there is an *Upper Paleolithic* period that recognizes the recently improved understanding of pre-Clovis prehistory, using a term coined by Williams and Madsen (2019). The Paleoindian grouping is divided into an Early Paleoindian—chiefly the time of Clovis and Folsom cultures—and a Late Paleoindian Period, which saw significant sedentary or territorial patterns emerge with San Patrice, Dalton, and other material cultures that each have unique geographic focus. It will be noted that the boundaries of Paleoindian and Archaic periods in this sequence (column 4) closely follow Central Texas usage (columns 5 and 6), and this is by design. As is explained in Chapter 7 with an analysis of regional point distributions, people from both Central Texas Edwards Plateau-based and East and Southeast Texas forest-based material traditions hunted in the western prairie part of the project area, and this overlap brought many Central Texas point styles directly into the Southeast Texas area. Moreover, neither of these regions ever saw a substantial development of agriculture during prehistory, and both remained places of hunter-gatherer cultures until the Historic Period. The only significant conceptual difference between Southeast Texas (column 4) and Central Texas usage (columns 5 and 6) is the inclusion of an "Early Ceramic" Period in Southeast Texas, following Patterson's and Aten's usage, which recognizes the arrival of ceramic technology in Southeast Texas. Although the Central Texas Toyah culture had ceramics (a bit later), their pottery is usually present in only small amounts (Arnn 2012), and is typically not emphasized in the Central Texas chronologic sequence. Finally, the Late Prehistoric Period in both regions is tied to the emergence of bow and arrow technology at about 1400 BP (AD 600; Aten 1983).

### An updated Southeast Texas lithic chronology

Much in Texas archeology has changed in the quarter century since Patterson's seminal report on Southeast Texas archeology, and some of those changes are reflected in a revised chart of lithic chronology used in this report (Figure 5.8; compare with Figure 5.6). A great deal of progress has been made by researchers, especially in nearby Central Texas, on tightening the temporal boundaries for lithic points, using both traditional radiometric data and, increasingly, optically stimulated luminescence (OSL) data. These new data have changed the understanding of the lower part of the archeological section in a fundamental way. In particular, age dates from the Friedkin and Gault sites in nearby Bell County, to the west of the project area, have redefined the temporal boundaries of the Early Paleoindian Period and in addition

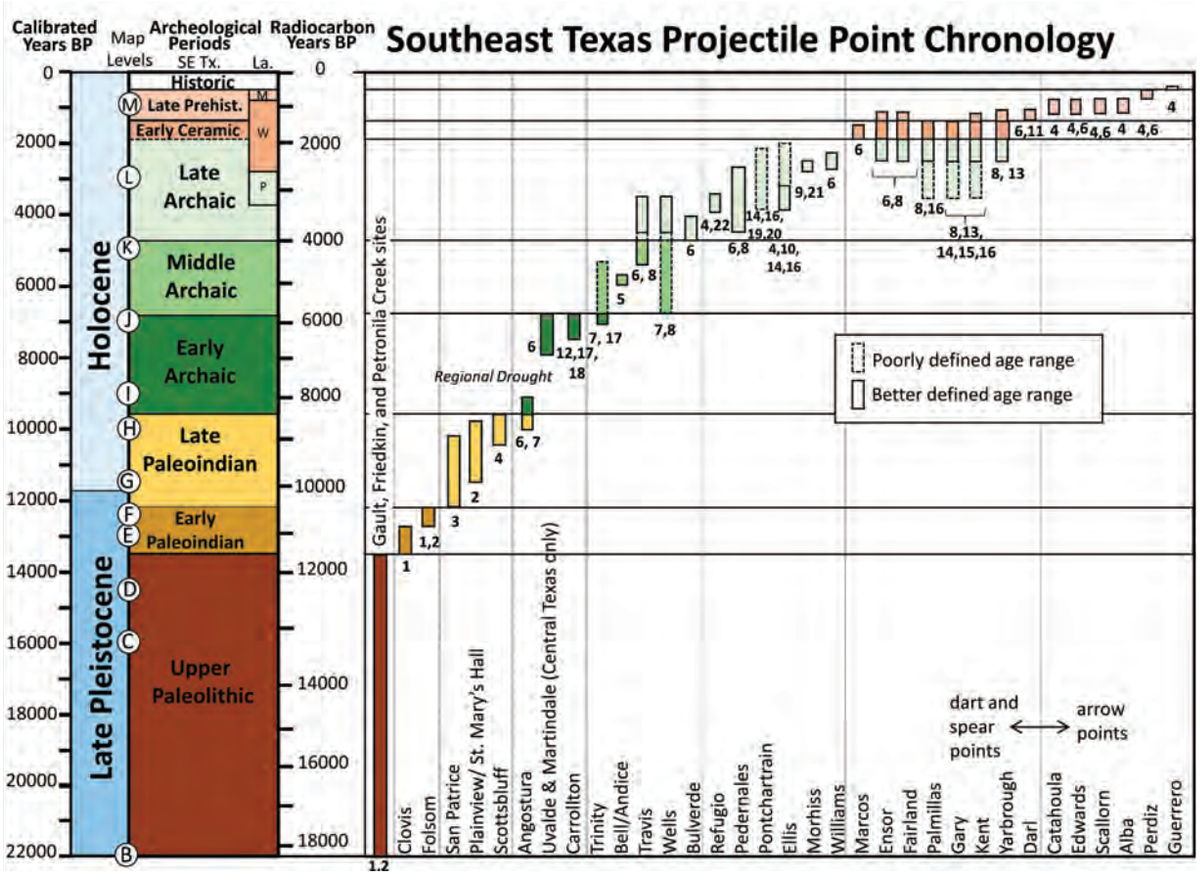



Figure 5.8. Revised lithic chronology for Southeast Texas projectile points, using radiometric and OSL dating where available from Central Texas, Southeast Texas, and the Lower Mississippi Valley. Archeological periods are as shown for Southeast Texas in Figure 5.7. (At upper right in the periods column are Louisiana late-stage designations, shown for reference: P = Poverty Point phase of the Late Archaic Period, W = Woodland Period, M = Mississippian Period.) This updated chronology is used for assigning lithic distributions to the time-sensitive paleogeographic maps discussed in Chapter 10: circled letters B–M in the periods column tie to those maps. All temporal ranges of point styles should be regarded as approximations. Data sources:

1. Williams et al. (2018)
2. Waters et al. (2018); Turner et al. 2011
3. Jennings (2008)
4. Turner et al. 2011
5. Lohse et al. (2014)
6. Collins (2004)
7. Prewitt (2017)
8. Hall (1981)
9. Taylor et al. (1995)
10. Perttula (2013)
11. Carpenter and Paquin (2010)
12. Patterson (1988, 1996)
13. Ensor and Carlson (1991)
14. Hays and Weinstein (2010)
15. McGimsey (2010)
16. Lehman (1982)
17. Crook (2020a)
18. Patterson (1998)
19. Ford and Webb (1956)
20. Connaway (1977)
21. Dockall and Black (2006)

have documented a lengthy Upper Paleolithic (pre-Clovis) Period of early occupation that was unknown in 1996 (Waters et al. 2011, 2018; Williams et al. 2018); the Upper Paleolithic term follows the usage of Williams and Madsen (2019). The Early Paleoindian Period as used here consists primarily of the time spans of Clovis and Folsom lithic technology. Known radiometric and OSL dates for Early Paleoindian Clovis sites in the region range from 12,700 to 13,000 calBP (Williams et al. 2018), and new dates from the Friedkin site in Bell County, Central Texas, roughly match that range (Waters et al. 2018). Clovis points at the nearby Gault site are roughly time-equivalent, but range as old as 13,500 years (Rodrigues et al. 2016), resulting in a total duration for Clovis material culture of considerably less than a thousand

years. In similar manner, Early Paleoindian Folsom points are slightly younger than Clovis and are considered to range in age from 12,200 to 12,700 BP (Waters and Stafford 2014).

Other studies, some outside of Texas, have allowed a much tighter understanding of the temporal association of some significant material cultures, in particular, that of San Patrice culture (Jennings 2008). Still other studies, notably those of Prewitt (1995, 2017, 2019) place improved temporal and geographic boundaries on Central Texas point styles that are relevant to Southeast Texas, because roving hunters from Central Texas often hunted bison in the Katy and San Bernard prairies. Ages of lithic points in northeastern Texas have benefitted from the compilation work of Perttula (2013) and Carpenter and Paquin (2010).

The Late Paleoindian Period as used here (Figure 5.7) begins at the end of Folsom technology, at 12,200 BP, and ends at about 8500 rcyBP (about 9200 BP). This period is known as "Paleoindian I and II" in the usage of Prewitt (2017). Angostura points are known to span the interval 9,600 to 10,400 BP (Collins 2004 and Prewitt 2017), and those at the Friedkin site have a similar temporal range (Waters et al. 2018). Jennings (2008), using radiometric dates from the well-stratified Big Eddy (Missouri) site as well as the Horn Shelter no. 2 and Rex Rogers sites in Texas, placed the range of the San Patrice occupational period at 10,000 to 10,400 rcyBP, possibly extending to as young as 9,000 rcyBP.

For the long Archaic period, Patterson's admittedly arbitrary subdivision of the Archaic into three periods has been replaced with periods tied to Central Texas usage, based upon lithic point analysis from Prewitt (2014, 2017) and from Collins (1995, 2004). The age dating of some eastern Texas points (such as Gary, Kent, Palmillas, and Yarbrough) and a few points from the Central Texas tradition (Fairland, Marcos) benefitted from the work of Hall (1981), who described them in carefully dated burial contexts. These eastern points tend to be made from chert from Tertiary gravels in the Trinity and Sabine-Neches drainage basins as well as from silicified wood sourced from eastern Texas and southwest Louisiana (e.g., Crook et al. 2017).

The temporal estimates of the Early Ceramic and Late Prehistoric periods shown in Figure 5.8 were tied by Patterson (1996) to the reasonably well dated arrival of ceramic and bow-and-arrow technology in Southeast Texas (Aten 1983) and are unchanged from Patterson's work.

For all of the temporal range estimates for individual point types, it should be emphasized that they are not exclusive; the next archeological study in the same vicinity may find the same point to be slightly older or younger than the age shown. The ranges show only what is known today. Nonetheless, a distinct learning of the last 25 years, since Patterson's work, is that point types seem to be less expansive in their time range than Patterson previously thought or was able to show. Collins and others (2011) suggest that many projectile points are tied to pulses in bison abundance, which in turn are tied to climatic pulses. Periods of moderate moisture favored bison in the Texas plains and prairies, whereas relatively dry periods favored their absence (Dillehay 1974 and Lohse et al. 2015). The briefness of those moist pulses, punctuated by dry spells, would presumably favor innovations in projectile design as new generations picked up the bison hunt, and would result in point designs with fairly brief periods of use. To the extent that that hypothesis is correct,

the temporal range of point styles shown on this chart may be expected to tighten further as archeological studies continue in the future.

### Use of the revised chronology in this report

The ultimate goal of this report is to tie archeological data to the suite of time-sensitive paleogeographic maps discussed in Chapter 2. These resultant maps (labelled B–M on Figure 5.8) are presented in Chapter 10. To that end, the time-specific projectile point ranges shown in this revised chronology have been used to construct nearly all the maps contained in the rest of this report. It is hoped that these time ranges allow us to select the best candidates from the lithic points database to relate to the new paleogeographic maps.

In the hundreds of site reports written by Houston Archeological Society members in their 60-year history, Leland Patterson was a first or second author of perhaps a majority of them. His interpretation of site chronology is written into each of these reports and reflects the earlier chronology depicted by Figure 5.6. Thus in some cases the periods discussed here do not match exactly the periods discussed in Patterson's original HAS reports.

As in Patterson's day, though, *caveat emptor.* The lithic chronology of Southeast Texas and the rest of the state is still a work in progress, and some of the time spans used here in displaying lithic chronology have the same inherent lack of precision that some of the map-based coastlines do from a geologic perspective. In all cases, temporal boundaries assumed for projectile points should be considered approximate, just as are the temporal assignments of the positions of coastlines in the palinspastic maps.

## Potential for sampling bias

A unique aspect of the project database that forms the core of this report is its geographical spread and diversity. Leland Patterson wrote on several occasions that the then-young Houston Archeological Society should collect archeological data strategically to fill in gaps (especially geographical gaps) in knowledge, and not just conduct reactive studies as a response to serendipitous opportunities that arose. The resulting project database and its new GIS linkage thus comprise a unique multicounty regional database of archeological information that can be placed on maps to extract relationships among archeological variables and their positions in physical (paleogeographic and landscape) space. This digital database of 537 sites will be queried in map view, and thus parsed to answer questions like: Where did Southeast Texas native people make pottery? Where did they hunt bison? Did they trade for items like red ochre and asphaltum? And so on. In Chapters 6–8 these sites are subdivided into three "Lifeway Zones" in an attempt to broadly characterize human interactions with their environment through time.

Before proceeding with this use of the database, it is important to ask what sampling biases might be inherent in it that may affect interpretations made from the data. In other words, does a blank place on the map imply that nothing occurred there, or was it never sampled for some reason? Was it already covered in urban concrete before anyone thought to look there? Might there once have been

a site there that was deeply buried and thus out of reach? Or eroded away? And do any of these factors seriously impact our ability to use numbers of sites vs. time to estimate population trends? These are all difficult questions, and the discussion that follows is aimed at providing a qualitative feel for the issues.

In general, archeological sites in the study area consist of soil *middens* (or shell middens along the coast) that rise very slightly above the surrounding ground level. These are prehistoric refuse piles that typically consist of bits of stone, pottery, and animal bones, very occasionally accompanied by human burials, that are contained in a soil matrix typically three feet or less in thickness. Even significant sites are usually very subtle features, and usually rise above ground level by only a foot or so. They vary in areal extent from just a few feet in length to a hundred or more feet in length at a maximum; see Wheat (1953) for multiple examples. Judging from ethnohistorical information, they reflect old campsites or temporary village sites. Some have been found by property owners who come upon one or more lithic points at the surface, others are searched for by trained archeologists, either professional—typically involved in contract Cultural Resource Management projects—or, more commonly, by avocational archeologists following up on leads obtained from homeowners or from archeological trends. They are sites very easily destroyed by earthworks associated with residential and commercial development, by flood control stream bank work, and by looters and pot hunters.

### Potential for sampling bias related to undersampling of small streams

As can be seen in Figure 5.9, the vast majority of sites in the database have been found along rivers, small streams, and bayous. This reflects Native American needs for water, shade, wood (for firewood and shelter), and food. In detail, there is much difference in site densities along various of these watercourses. For example, streams in parts of the Katy and San Bernard prairies are lined with a great many sites that span a broad range of ages (e.g., see Figure 5.9 locations 1 = Cypress Creek, 2 = White Oak Bayou, 3 = uppermost Buffalo Bayou tributaries, 4 = the small San Bernard River and Peach Creek, and 5 = small streams on the open prairie in Grimes County). However, other nearby creeks of similar size and position in the landscape are seemingly bereft of sites (6 = Braes and Sims bayous, for example, or for that matter 7 = the main length of Buffalo Bayou), posing the question of potential sampling bias. As hypothesized in Chapter 8, the streams in prairie areas that have a great density of sites are those that are favorable to the needs of bison hunters, so in this case a sampling bias is not necessarily the reason for variations in site density along prairie streams. In similar fashion, small streams in the East Texas Pineywoods and Big Thicket areas have provided very few published sites (e.g., the streams in areas 8, 9, and 10) except where at a nearby ingress of the adjacent prairie into the western edge of the forest (Grimes Prairie edge, 11, and location 12 yet farther to the north). This would appear to relate to the facts that (a) plains bison do not typically live in the deep forest, and (b) the relative richness of food resources found in the relatively broad floodplains of the main rivers (Trinity, San Jacinto, Neches, Sabine) versus those of small forest creeks means that those larger river environments were

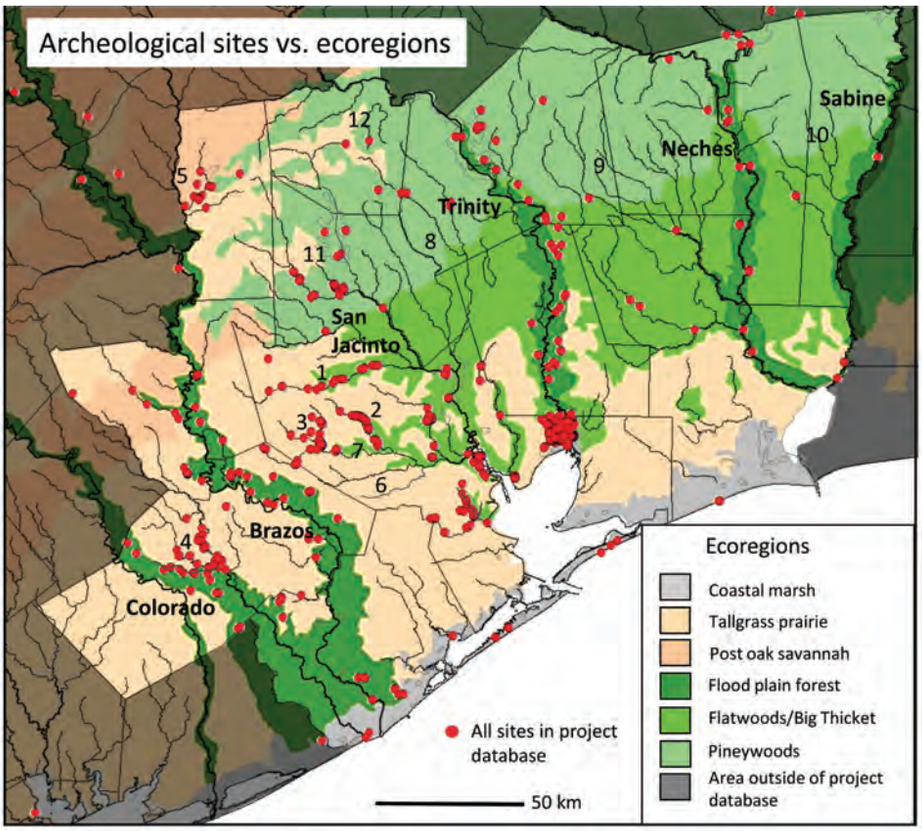



Figure 5.9. Locations of all archeological sites in the project database, su-perimposed over landscape ecoregions as shown in Figure 3.7. Archeological sites include Patterson-HAS data plus sites compiled by Story (1990) and Bousman and others (2004).

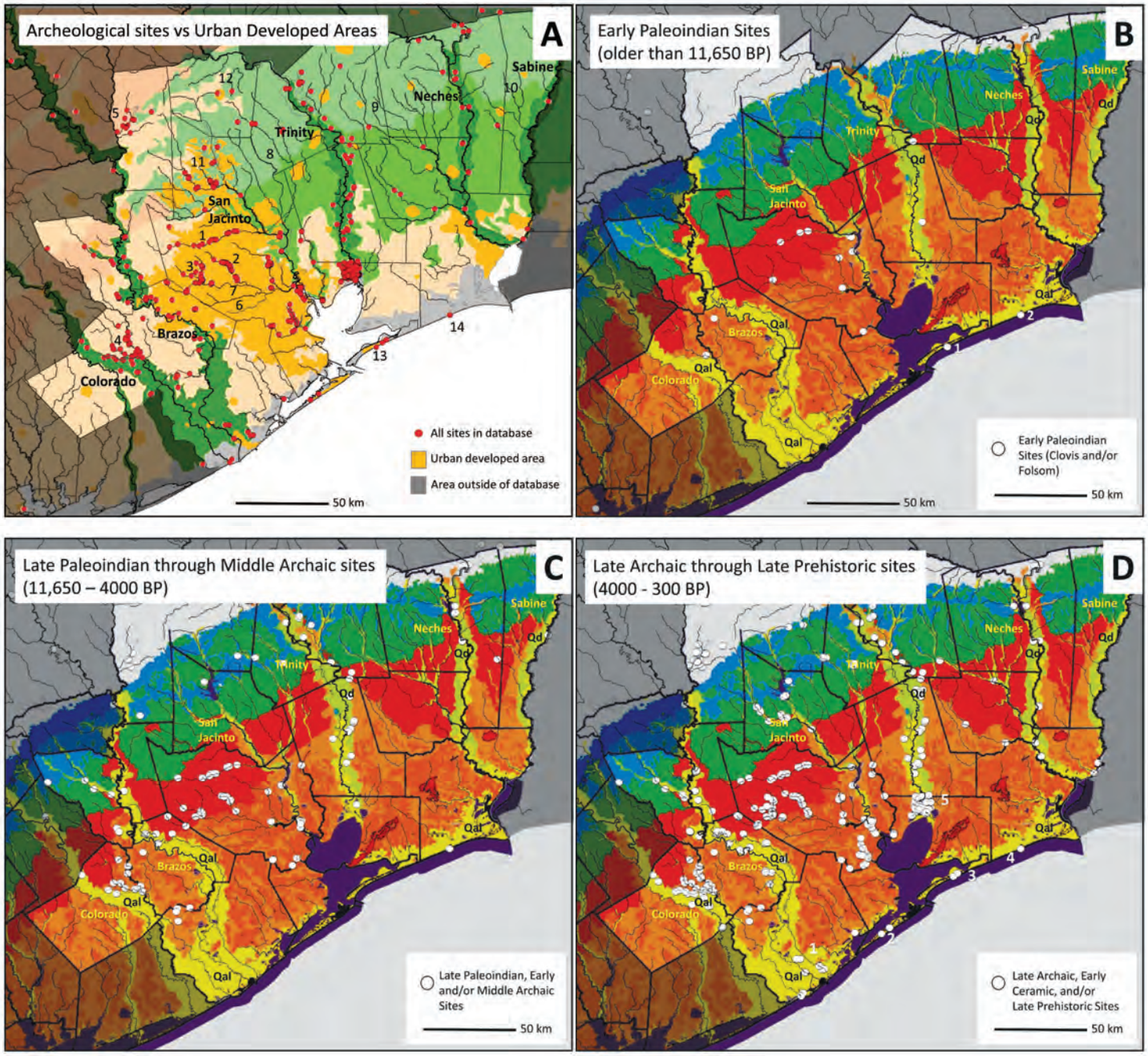
where native people preferentially chose to live. Thus no particular sampling bias is seen in the scarcity of sites along small streams in the deep forest.

### Potential for sampling bias related to distance from Houston

Because most HAS members live within the city of Houston or its developed suburban areas, it is reasonable to expect that most HAS activities have occurred near there and that there might be a bias in locations of sites relatively closer to Houston's center. In Figure 5.10 A, urban developed areas are shaded yellow. The largest of these, just left of the center of the map, represents the developed area of Greater Houston. While the number of investigated sites there is large, there are also many other sites outside that developed area, including along the lower Trinity River as well as along the Brazos and Colorado rivers and the intervening San Bernard Prairie (location 4). Those latter sites are largely due to the enthusiasm and dedication of HAS member and area rancher Joe Hudgins, whose zeal, combined with the availability of accessible sites with friendly landowners, led to a remarkable series of eastern Wharton County studies in the 1980s to early 2000s. However, distance from the core does seem to be a factor in the relative dearth of sites along the Neches and Sabine rivers, which are located far from Houston. The eastern bank of the Sabine, in Louisiana, is accompanied by many archeological sites, according to a map of recorded archeological sites as of October 2018 (Girard et al. 2018, their Figure 2), but they are unpublished and thus not included in the present study.

### Potential for sampling bias from urban destruction of sites

The only large urban areas in Southeast Texas include Greater Houston and the Beaumont–Port Arthur area (Figure 5.10 A). There is a distinct lack of project database sites in the Beaumont–Port Arthur area. Yet there is a large number of sites in the Atlas of Texas Archeological Sites of the Texas Historical Commission along the Neches River in the Beaumont–Port Arthur area—most of them shell middens. There are no extant archeological publications describing these sites (William E. Moore 1989; Aten 1983). These sites were destroyed in 1893, when mined for their building material (Block 1977; see discussion, Chapter 4, this volume). This




destruction came before the advent of serious archeological investigations to the region in the 1940s.

The previously mentioned dearth of sites along Braes and Sims bayous (on either side of location 6 in Figure 5.10 A) and along a large part of the middle length of Buffalo Bayou (location 7), are notable relative to very large numbers of sites at adjacent White Oak Bayou (2) and the upper tributaries of Buffalo Bayou (3). All the bayou areas just mentioned were developed starting in the 1950s, and the flood control efforts that have destroyed most sites in White Oak, Braes, and Sims bayous did not commence until the 1960s. There seems to be no obvious reason, from an urban development standpoint, for the lack of archeological sites along Braes and Sims bayous relative to White Oak Bayou and the upper tributaries of Buffalo

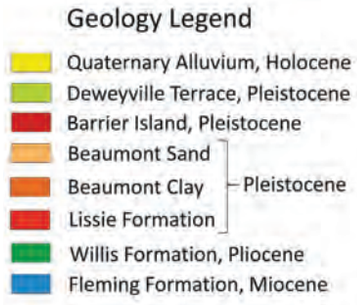


Figure 5.10, A-D. Maps highlighting aspects of potential data sampling bi-ases (see text for explanation): Frame A compares the locations of archeological sites in database with positions of modern urban developed areas. Underlay map depicts ecoregions. Frames B–D compare the age of archeological sites in the project database with their geologic setting (the underlay is from the *Geological Map of Coastal Texas,* courtesy of the Texas Bureau of Economic Geology). Note the subtle dis-tinction in color between yellow-shaded Quaternary alluvium (Qal), which is essentially Holocene in age, and yellow-green Deweyville Terraces, which are Late Pleistocene in age and occupy a slightly elevated position in river val-ley floodplains (especially in the Trin-ity valley). Broad swaths of Holocene Qal are found only in the Colorado and Brazos river valleys and in some coastal marshes. Note that in Frame D, many inland sites of late Holocene age (Late Archaic through Late Prehistoric Periods) occur within the area of Qal. This suggests that some potential sites of older ages (see maps B and C) may have been buried by Qal river alluvium.

Bayou. As mentioned earlier, it is possible that the reason lies in the relative desirability of the Braes and Sims bayous for hunting bison (see discussion, Chapter 8).

### Potential for sampling bias from geological burial of sites

The time span extending from the oldest sites yet found in the study area (sites with Clovis materials, dating from about 13,500 BP) until today is a long period of time from a historical or archeological vantage point, but it represents only a very small amount of time from a geological standpoint. Nonetheless, is it possible that significant numbers of additional early sites dating from the Late Pleistocene (Early Paleoindian, including Clovis, and potential older sites) might have been buried by Holocene sediments? In that case Late Pleistocene sites would be under-represented in our database.

The maps in Figure 5.10 B–D have been designed to address this question. Except for the floodplains of the Brazos, Colorado, and parts of the Trinity, Neches, and San Jacinto rivers, the area is underlain by geologic strata that are Pleistocene or older, and those areas have seen only erosion (no widespread deposition) during Late Pleistocene and Holocene time. The chances of burying Early Paleoindian (Late Pleistocene) potential sites in the vast part of the area is thus exceedingly slight, as almost all of that region has been experiencing subaerial exposure (and erosion) during this time.

Within the large river floodplains, the situation is different. The maps depict young strata of two ages:

In a yellow-green color, so-called "Deweyville Terraces" (labelled Qd) pre-date the Last Glacial Maximum and, it is assumed, pre-date the arrival of humans in the area (see Figure 2.5 and accompanying discussion in Chapter 2). These terraced strata are typically dated at 25,000 to 50,000 BP, older than the earliest known humans in our region. Because of their terraced elevation above the current river channel, the terraces were favored locations for campsites. There would seem to be little potential for significant burial of Late Pleistocene human sites in those areas.

In yellow, Quaternary alluvium (labelled Qal) generally postdates the last Glacial Maximum and is characterized as—approximately—Holocene in age. The Holocene Epoch began at 11,650 BP, and its time range encompasses archeological periods that are Late Paleoindian through Late Prehistoric (see time scale, Figure 5.8).

Early Paleoindian Period sites are shown on Figure 5.10 B. All the sites of this age are inland sites; the shoreline at this time was around 140 miles out on the current continental shelf (Chapter 2), where any potential Early Paleoindian shell middens would lie. There are two Early Paleoindian sites along the Trinity River; each is associated with Pleistocene Deweyville terraces; these early people often used such terraces to live close to but slightly above the river's floodplain. Such is likely the case for two sites shown along the San Jacinto River. There are two sites on Quaternary alluvium (Qal) of the Bolivar Peninsula (location 1, 41GC101; Huebner 1988) and farther up the coast at McFaddin Beach in Chambers County (location 2, 41JF50; Long 1977; Hester et al. 1992; Turner and Tanner 1994; Stright et al. 1999) that both contain Clovis-age material that has recently washed up from an offshore submerged source site. These sites are not in place. The remainder of the

sites rest on the old Pleistocene-Pliocene erosional surface of the Beaumont and Lissie formations. The lack of in situ Early Paleoindian sites on Qal suggests either that Early Paleoindian hunters did not camp in low-lying areas, or that if they did, those sites have since been buried. A geologic core cross section across the Colorado and Brazos river valleys (Figure 2.23) shows the nature of the problem; the 12,000 BP surface along that cross section is buried under at least 10m of younger sediment. Thus, any area showing Qal has potentially denied us the ability to see Early Paleoindian artifacts. Fortunately, the total percentage of the overall project area represented by Qal is small, but the potential effect upon the representation of Early Paleoindian stream sites is high.

Figure 5.10 C includes sites of the Late Paleoindian, Early Archaic, and Middle Archaic periods. There are several times more archeological sites than on the previous figure, but the effect is the same. The numerous sites on the Trinity and Neches rivers are located on high Deweyville terraces, and excepting the not-in-place aforementioned McFaddin Beach site, all the remaining sites are on the eroding Pleistocene-Pliocene Beaumont and Lissie Formation surface, including several sites along the Colorado and Brazos rivers where sites are located on the Beaumont on the rim of the river valleys. There are no sites located on Qal. The cross section of Figure 2.23 shows that stream strata of correlative ages to these periods is buried under several meters of Qal fill.

Finally, the Late Holocene map of Figure 5.10 D includes sites of Late Archaic, Early Ceramic. and Late Prehistoric age: sites younger than about 4,500 BP. The number of sites has increased markedly from the previous figure, and in this case there are a number of sites located on Quaternary alluvium, including seven sites on the Brazos River delta (location 1), two on Quaternary beach sand of Galveston Island (location 2), two on Bolivar Peninsula (location 3), and one at McFaddin Beach (location 4). An additional site is located on Qal in the upper segment of the Brazos in Fort Bend County; others that appear to be on Qal on the map are actually on the prairie rim or on small inliers of Pleistocene strata within the floodplain. Each of the abovementioned coastal sites is considered to be in place; for example, Stright and others (1999) considered points of Late Archaic age recovered at McFaddin Beach to have been deposited in place rather than washed ashore. Location 5, the lower Trinity River delta, has a large number of shell middens located on the very young delta. These middens reflect rising sea level that has brought brackish water conditions, and hence brought Rangia cuneata, marine to brackish water clams, to the attention of Native Americans, who built the middens with the refuse from their food (see discussion, Chapter 6). These can be neglected for the moment; older antecedents to them (for example, in Early Paleoindian through Middle Archaic time) would ostensibly be found in the present day offshore and are not present on this map because of submersion, not geologic burial (Chapter 10). Overall, the number of these youngest sites located on Quaternary sediments is still small (12) compared to the overall numbers of sites of that age on the Pleistocene erosional surface (200+; see below). This would suggest that a) Native Americans tended not to stay for very long in the unstable river bottom flood plain (they seem to have preferred to stay on the valley erosional rim or on relatively high river terraces, and b), sampling bias due to burial by riverine Qal in earlier times (maps B and C) may be similarly small.

## Potential bias from geological erosion of sites

Another potential source of sampling bias includes the disappearance of early occupation sites by bank erosion near meandering rivers and streams. Most sites are located on topographic high points but very close to rivers or stream beds. Erosion via bank collapse during flood stage or erosion of middens via stripping by rapid overwash during floods is an ever-present possibility; middens are thin refuse piles that are easily disturbed. At Dimond Knoll on Cypress Creek (41HR796), archeologists carefully calibrated soil ages at the midden, receiving an oldest (lowest) date from OSL of 9690 ± 620 BP. However, San Patrice points from elsewhere at the site date from the Late Paleoindian Period, considerably older, usually within a range of about 10,100–12,300 BP—significantly older than the oldest part of the midden deposit. Jason Barrett, the lead archeologist on the project, suggests that the rare San Patrice points at the site represent stone lag left behind when Paleoindian Period materials were removed by stream erosion (Barrett, personal communication, 2019).

How large a problem is presented by erosion of early material by streams during the Holocene is difficult to estimate. However, it has long been noted that there are many more very young sites (e.g., Late Prehistoric and Early Ceramic) than there are Paleoindian and Archaic sites. Were early sites strongly affected by erosion, and hence under-counted? Another point of view has been that the lesser numbers of sites in older times (i.e., pre–Late Archaic) represent a lesser population in those periods, and that population has grown with time (Aten 1983; Patterson 1996). To examine the problem further, we need to examine the population arguments and then compare the two potential cases.

## Population dynamics versus sampling bias from site burial or erosion

The project database divides all sites into two basic types (shown in map view in Figure 5.11), after Patterson:

> "Inland" sites that, in addition to lying typically (but not always) in inland locations, consist of soil (or, rarely, freshwater mussel shell) middens.
>
> "Coastal" sites that typically lie near the coast and consist of marine shell middens.

It is a useful distinction, as can be seen in the bar chart of Figure 5.12. Whereas inland sites range from Early Paleoindian through Late Prehistoric in age, coastal shell middens are only as old as the very end of the Early Archaic. The oldest marine shell midden is at 41GV53, where a Rangia cuneata clam shell at the bottom layer of a midden yielded a data of 5,340 rcyBP, or about 6,200 BP (the red star on the bar chart; Patterson et al. 2001). It records the first intrusion of brackish water conditions (hence the arrival of edible Rangia) at that site, as sea level rose and Galveston Bay continued to flood in Holocene time (see Chapters 2 and 10).

The shell midden at 41GV53 rests upon a yet older soil midden that includes projectile points from the Early and Late Paleoindian periods, in a "normal" inland setting. A perusal of Figure 5.11 shows that there are a few other "inland" soil mid-

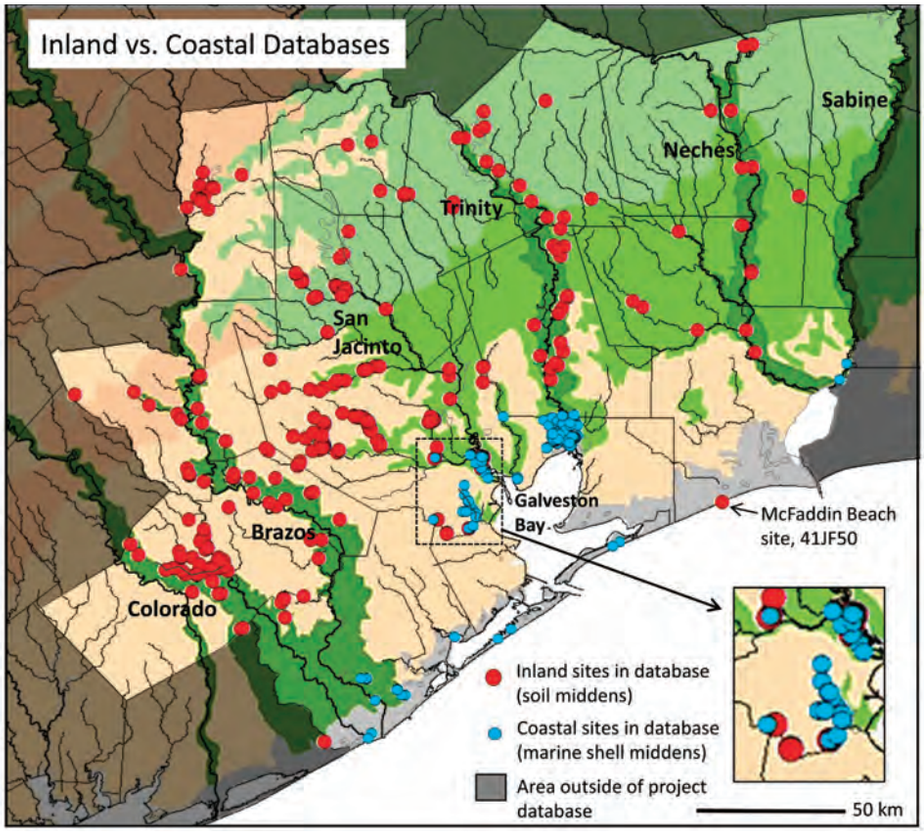



Figure 5.11. Sites of the inland vs. coastal databases in the project database.

den sites in and around the younger "coastal" shell middens on the northwest side of Galveston Bay (inset map). These were campsites along formerly freshwater streams that, by the end of the Early Archaic Period, were transformed into brackish water streams as sea level rose. The brackish water zone reaches about 12 miles inland today in creeks and rivers, providing a useful guide to past positions of the coastline.

Aten (1983), who studied mostly coastal sites during the 1960s and 1970s, when most of the inland sites contained in the project database had not yet been excavated, used numbers of observed archeological sites sorted by archeological age to estimate the past population of coastal Akokisa and their predecessors. Using historical data from Spanish accounts, he calculated that the Akokisa population consisted of about 1,400 individuals in the area during the early Historic Period (see discussion, Chapter 4). Using numbers of archeological sites, he estimated that the proto-Akokisa numbered about 86% fewer at the end of Middle Archaic time, or only about 200 individuals—a severe drop (his Figure 17.1). A problem with Aten's approach is that as already mentioned, the increasing number of coastal middens since the Middle Archaic reflects the fact that large numbers of Middle Archaic coastal midden sites were drowned by rising seas and an expanding Galveston Bay— factors that have nothing to do with population increases. Perhaps a better calculation would be one using only inland sites. Middle Archaic inland sites (62; see Figure 5.12) are 29% as numerous as Late Prehistoric inland sites (211), yielding a calculated potential Middle Archaic population of 411 people. Extending that calculation any farther back in time is not particularly useful, as large amounts of coastal territory corresponding to those earlier times is beneath the Gulf of Mexico, rendering the count of Southeast Texas archeological sites grossly incomplete.

In adjacent Northeast Texas, far from the issues related to sea level rise at the coast, Perttula (2012) compiled the number of dart points found in the region by archeological periods. He calculated the number of points found in each period of Archaic and Woodland times per century of actual elapsed time for each period, and noted how point numbers steadily increased in his sample from the Early Archaic (0.8) to the Middle Archaic (5.5) to the Late Archaic (21.0) to the Woodland Period (38). While not attempting to project population numbers directly from these data, he nonetheless suggested that the increases probably indicate increasing population, which is in general agreement with the preceding calculation.

No matter how one extrapolates population from scant archeological data—qualitatively or quantitatively—it is a process fraught with issues of data bias, numerous complex assumptions, and abundant paths to error. Nonetheless, it seems reasonable to conclude, with Perttula and Aten, that population in the area was generally increasing up until the beginning of the Historic Period, when disease and displacement abruptly cut short the Native American presence.

### Population increase or site loss? Or both?

Returning to the earlier issue, where we considered the importance of a possible data bias due to site destruction in inland stream areas via systematic erosion of early sites by stream flooding, there is a choice to be made. Either the increasing numbers of archeological sites in the project database with time denote a general increase in population over time (Aten's supposition), or the relatively lower numbers of early inland sites are due to loss of some number of early sites due to geologic erosion—or perhaps a combination of the two factors. It would not seem to be possible given current information to separate the effects of the two factors.

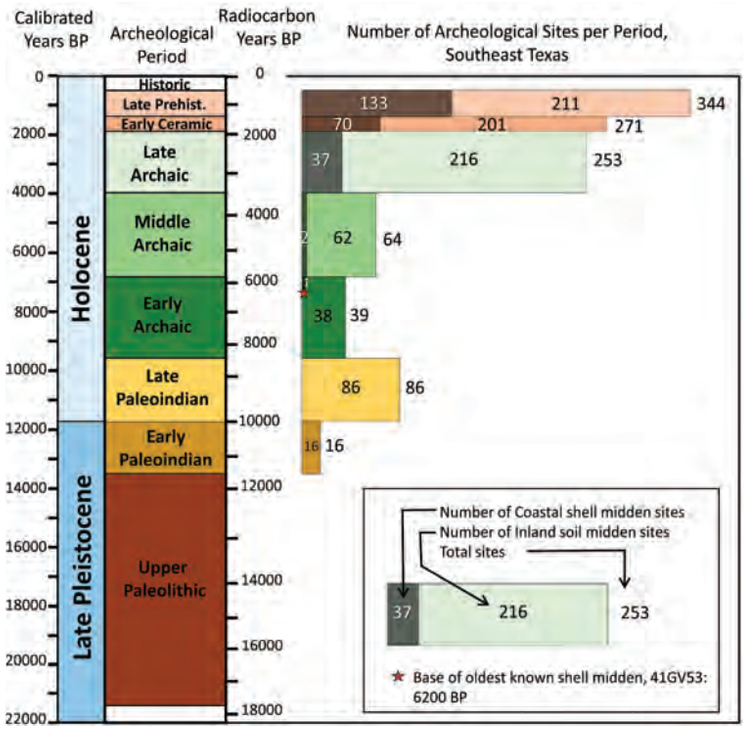



Figure 5.12. Bar charts showing the number of archeological sites by period. The number of sites per period is divided into those with marine shell middens (coastal zone) vs. those from (inland) midden deposits with a soil matrix. This chart uses the original Patterson lithic chronology for all periods except the Paleoindian period, which has been subdivided into Early and Late portions.

## A note on the preservation of archeological sites

Using GIS technology for the display of large amounts of regional archeological data is in its infancy in Texas. It is instructive in this regard to review the efforts of Bexar County archeologists at the Center for Archeological Research at the University of Texas at San Antonio (CAR-UTSA) to display similarly online in map form the general locations of all of their county's archeological sites using GIS mapping technology. Their site locations are tied to multiple time-specific topographic and geologic maps of various time periods (Nowlin 2018). Our approach here has similar aims. As with the Bexar data, we show locations only as broad circles of one or more kilometers in diameter, on maps without modern roads, property boundaries, or latitude-longitude tick marks. In general, only

river and stream locations are shown, on regional-scale maps.

This lack of geographic specificity is intended to help protect archeological sites. Sadly, very many sites studied by HAS and other researchers in the past 60 years—including many sites discussed in this report—have since been destroyed by somewhat inevitable factors of urban development, road construction, and stream flood control efforts. Perhaps worse has been the destructive pothunting of both published and unpublished sites; this latter type of destruction needlessly destroys the ability of future archeologists to increase our understanding of our shared history. As our Bexar County colleagues have pointed out, "When sites are looted and excavated in the hunt for beautiful artifacts, we lose the archaeological context around these objects that allows us to tell the stories of the people who created them and how they lived" (Nowlin 2018). The volunteers of the Houston Archeological Society and other Southeast Texas archeological societies have helped many landowners understand the prehistory of their property while yet preserving important information on our shared prehistory, in the form of technical reports. It is hoped that one of these these societies, or either CAR-UTSA or the Texas Archeological Research Laboratory of the University of Texas at Austin, will be called when questions arise regarding the preservation of a known or potential archeological site.

# 6.

# Coastal and riverine lifeways

In this and the next three chapters we explore the lifeways of Native Americans in Southeast Texas, based upon archeological, ethnohistorical, and physical landscape information. The term lifeways typically refers to a person's path through life, or customary manner of living. The term as used here also refers to the ecological position of Native Americans within larger Southeast Texas ecosystems. The region has a variety of ecological niches, each of which requires its inhabitants to make adaptive responses. Three lifeway zones are considered here: (1) the coastal zone, (2) large river floodplains, and (3) interior prairies (Figure 6.1). Lifeway zones 1 and 2 are considered in this chapter, and bison hunting on the inland prairies is discussed in chapters 7 and 8. The related topic of lithic procurement—obtaining stone materials for daily life—is taken up in Chapter 9.

The relationships of Native Americans to each of these environments—that is, the lifeway zones—are different, primarily because the methods for procuring food in each ecosystem are different. The ethnohistorical observations made of the lives of Akokisa, Bidai, and Coco people of the early Historic Period are important path markers to making sense of the lithic, bone, and shell artifacts of prehistory in each of the lifeway zones. The analysis presented in this chapter is conducted on static, present day geographic base maps, for the moment with little regard to temporal matters. As was mentioned in the previous chapter, Southeast Texas people were hunter-gatherers from the Upper Paleolithic through the early Historic Period.

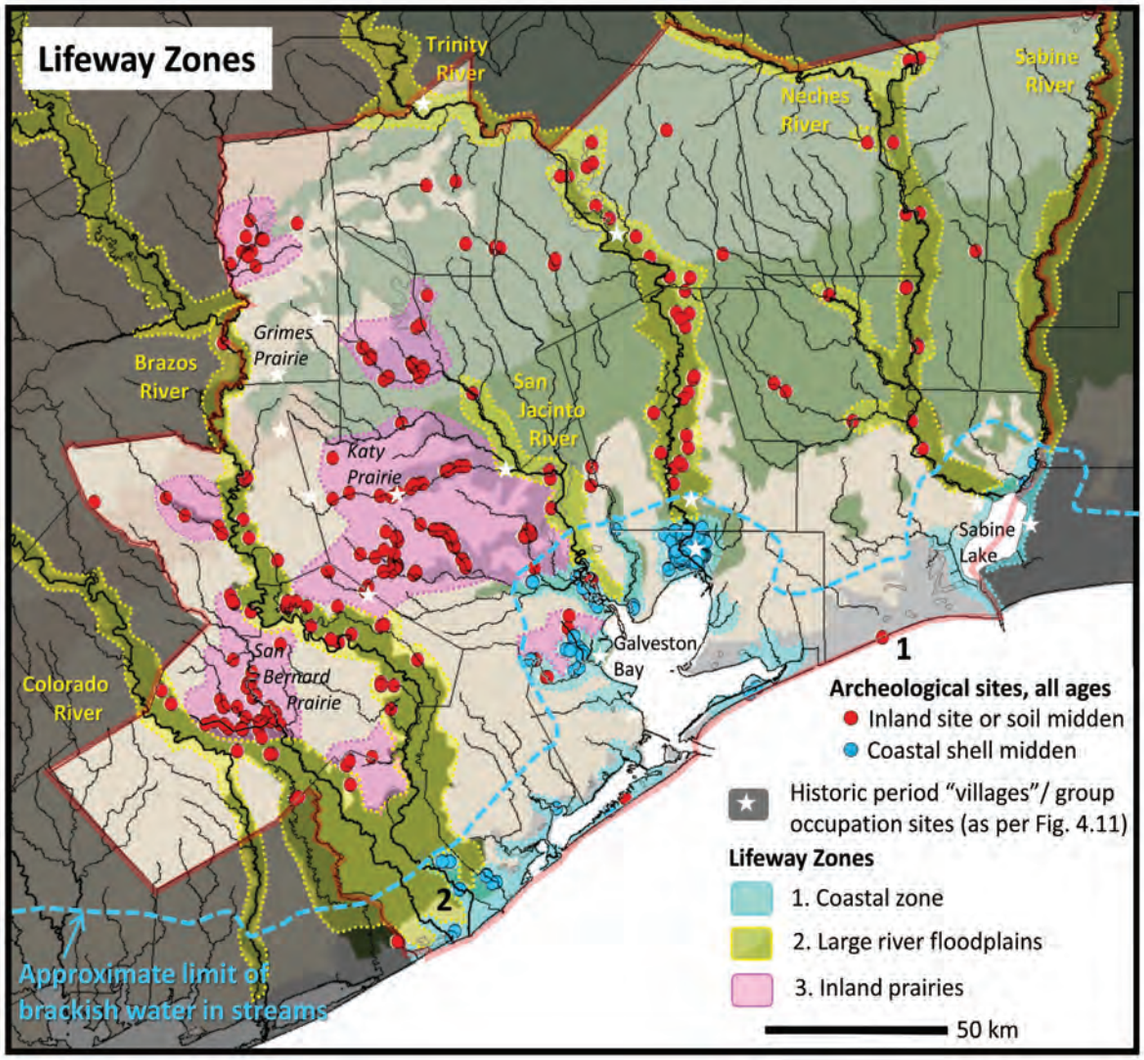



Figure 6.1. Three generalized "lifeway zones" for Native American activity in prehistory. Underlay map depicts ecoregions, as defined in Figure 3.7. The archeological sites shown include all sites in the project database.

Although certain technologies changed over this period, the basic relationship of people to each ecosystem in procuring food from that ecosystem seems to have changed little. The matter of tying archeological site data in these lifeway zones to time-specific paleogeographic maps, spanning the period from Upper Paleolithic through Late Prehistoric, is considered in chapters 10 and 11.

The map in Figure 6.1 includes all sites in the database, sorted by the nature of sites. Those with marine shell middens, which occur at or near the coast, are shaded blue. Interior sites, typically with soil middens, are shaded red. A few soil middens are found in near-coastal areas, either as remnants from earlier times when the coastline was farther seaward, or in interior parts of Galveston Island, where shell material was not available. A blue dashed line defines an upward limit to the coastal lifeway zone; it refers to the approximate limit of saltwater intrusion into area streams (the brackish water limit; more on this later).

Before proceeding, it is worth first discussing where Native American artifacts are typically *not* found—in other words, those areas outside the three lifeway zones depicted on Figure 6.1. First, Native Americans typically do not appear to have resided in significant numbers or for significant lengths of time along small streams (or anywhere else) within the dense East Texas forest, either in the Pineywoods

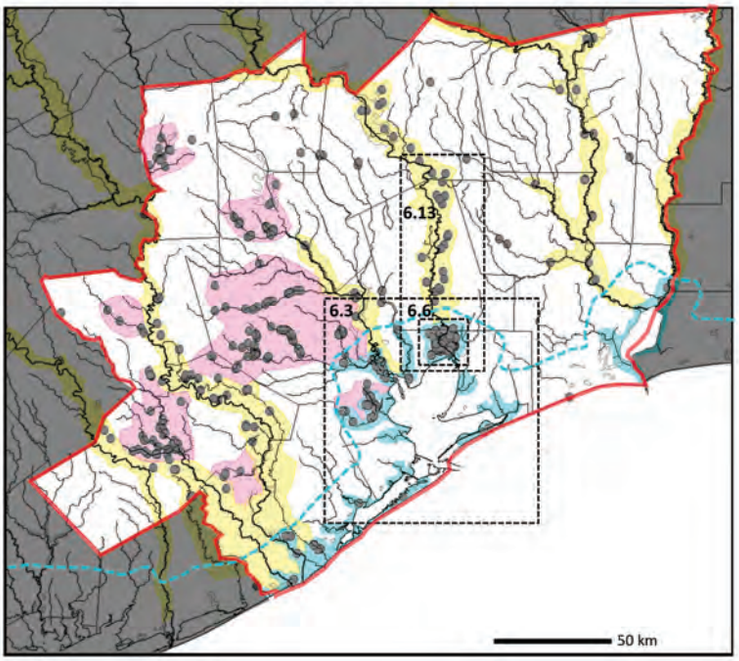



Figure 6.2. Index map showing locations of maps discussed in the text. Archeological sites and shading for lifeway zones are as in the preceding figure.

or in the Big Thicket. The reasons for this are self-evident. Both hunting and travelling in the dense forest interior was difficult. Moreover, the smaller streams lacked the broad floodplains of the larger rivers—the Trinity, Neches, and Sabine (and to a lesser extent the San Jacinto). These broad floodplains provided more varied plant food for game, and also had smaller meandering companion streams to the large rivers that were teeming with aquatic life. Finally, the largest game animal of most of this period was the plains bison, a prairie-loving animal that did not typically penetrate the deep forest areas.

In general, coastal Native Americans did not live on open prairies either, although they hunted them extensively. In the western prairies (San Bernard, Katy, Grimes, and other prairie areas farther north, as shaded pink on Figure 6.1), Native Americans seasonally resided on small wooded streams, where they based their hunting operations. These wooded streams also acted as entrapment zones for bison and deer, as discussed in Chapter 8. As the map shows, there have been few archeological sites found on the prairie away from these small wooded streams. The coastal prairies and marshes to the southeast of this inland prairie zone, for example in Jefferson and Chambers counties, are also nearly devoid of archeological sites, although undated bison bones were recovered at McFaddin Beach (Location 1: Stright et al. 1999). It is not altogether clear why this is; Joutel in 1688 noted frequent bison appearances in the near-coastal prairie at Matagorda Bay, for example. This may be an indication of sampling bias due to distance from Houston, discussed in the previous chapter.

## Lifeway Zone 1: Fishing and shell-fishing on the coast

The flat coastal lowlands and saltwater marshes surrounding Galveston Bay and the rest of the Southeast Texas coast are very young, geologically speaking. Only the old Ingleside beach ridge (Qi, Figure 6.3) at Smith Point on the east side of the bay is older than 100,000 years; it marks the position of the high stand during the most recent peak of an interglacial warm period 130,000 years ago, a reminder of how high sea level could rise as we slowly approach the climax of the interglacial warming in our own time (Chapter 2). Most of the landscape is underlain either by partly sandy (Qbs) or mostly clay (Qbc) facies of the Beaumont Formation, only a few tens of thousands of years old. The rest of the landscape is underlain either by younger still stream alluvium (Qal) in the Trinity and San Jacinto River floodplains, or by the ca. 5,000-year-old barrier bar ridges of Galveston Island and the Bolivar Peninsula.

In the nineteenth century the shorelines of parts of Galveston Bay, Clear Lake, and the San Jacinto and Trinity estuaries were prominently lined with numerous shell middens composed of clam and oyster shells, clear evidence of the meals of Na-

tive Americans in prehistory. Patterson (1993b, 2006) defined a "Coastal Margin Settlement Zone" on the basis of the presence of *Rangia cuneata* shells, the primary constituent of these middens. *Rangia* are brackish water clams found in tidally affected streams, wetlands, and coastlines (Figure 6.4). Patterson noted that *Rangia* cuneata do not live in fresh water and thus were limited within streams to about 12 miles (19 km) inland; this inland limit is approximately outlined in blue in Figure s 6.1 and 6.3. Shell middens are found seaward of this brackish water limit; the blue circles in figures 6.1 and 6.3 depict shell midden sites. Oysters are more dependent upon slightly higher salinities and are only found in the bays and the lower sections of streams and rivers. The coastline as well as stream banks to the inland brackish water limit comprise Lifeway Zone 1: the coastal zone (Figure 6.1).

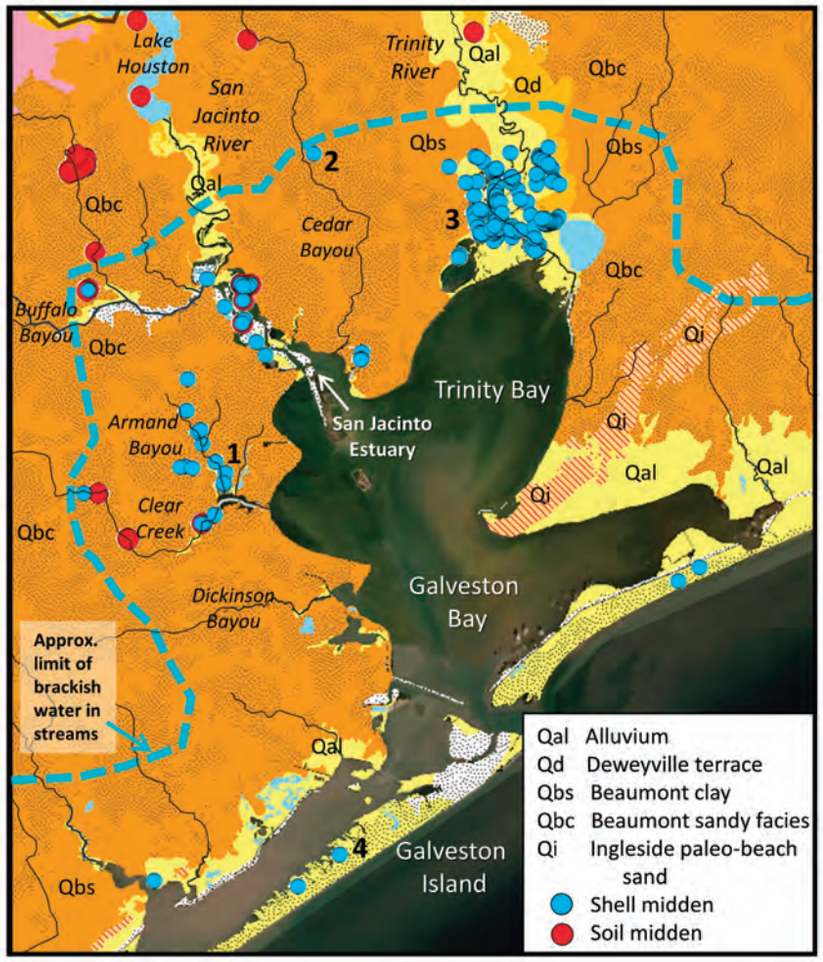



Figure 6.3. Shell midden sites of the Galveston Bay area. Base map depicts surface geology, from the *Geologic Map of Texas* online, U.S. Geological Survey. See Figure 6.2 for map location.

Published information on shell midden sites was compiled by Patterson (1989b) in a "Coastal Zone" database, an updated version of which was used in this report. Some of the most extensive published studies of these sites involve locations around Galveston Bay at the Harris County Boys School and Fullen sites (41HR80, 82, and 85) along lower Armand Bayou north of Clear Lake (location 1, Figure 6.3), studied by Aten and others (1976) and by O'Brien (1971); the J. D. Wells site on Cedar Bayou (location 2, 41HR639; and see Patterson 1990c); and various sites along the Trinity River estuary (location 3) by Aten (1983). Each of these studies described sites that contained *Rangia* shells or oysters, or both, along with remains of various fish, gar, alligators, turtles, snakes, birds, and small mammals such as opossums, rabbits, and raccoons. Another well-studied shell midden is the Dow-Cleaver site in the Brazos River coastal plain (location 2 in Figure 6.1; Aten 1971).

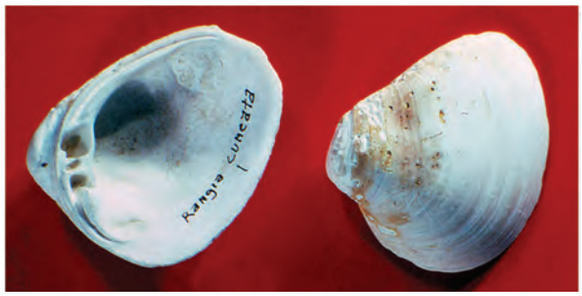



Figure 6.4. *Rangia cuneata* shells from the Texas coast. Image courtesy of Texas Archeological Research Laboratory, Austin.

The Fullen site is a small midden of about 20 m in diameter and less than a meter in thickness that was built of discarded *Rangia* and oyster shells along the shore of Mud Lake on lower Armand Bayou (location 1, Figure 6.3). Its excavation yielded 2,000 pottery sherds, about 10,000 fragments of animal bones from deer, small mammals, turtle, and gar, and a bison tooth. The pottery sherds are primarily of Goose Creek plain and incised forms. A number of socketed (hollow) deer bone projectile points were found; such points made of bone are common

in lithic-poor coastal areas and indeed may have been preferred for bow fishing (items i–k, Figure 6.5). Lithic artifacts include a Kent dart point as well as Catán, Perdiz, Alba, Bonham, and Catahoula arrow points, showing that this was a Late Archaic through Late Prehistoric Period site. Lithic tools were scarce and included a chert knife, a scraper, and a large fish net sinker with a hole drilled in it. The interpretation was that the site was an occasionally occupied small camp (O'Brien 1971).

Farther south along the bayou is a similar but larger shell midden site (41HR85), adjacent to a cemetery containing 12 Native American burials (the Harris County Boys School site of Aten and others, 1976). Grave goods were scant but included a bone fishing hook, deer antler and bone projectile points and awls, a shell bead bracelet, a number of bone flutes, and what may have been a rattle. Site occupation began in the Late Archaic, and the cemetery was used during the Late Prehistoric Period. Aten interpreted the occupants of the site as Proto-Akokisa. One of the most significant aspects of this site is a well-stratified continuum between the artifacts of the pre-ceramic Archaic occupation layer and those of the overlying Early Ceramic Period, with its numerous pottery sherds. Other than the addition of ceramics, the artifact assemblages for the two layers are very similar, suggesting a continuity in culture across that temporal boundary. This seems to demonstrate that the arrival of ceramic technology at ca. AD 100 was a newly learned skill, not a disruptive invasion by newcomers (Story 1990).

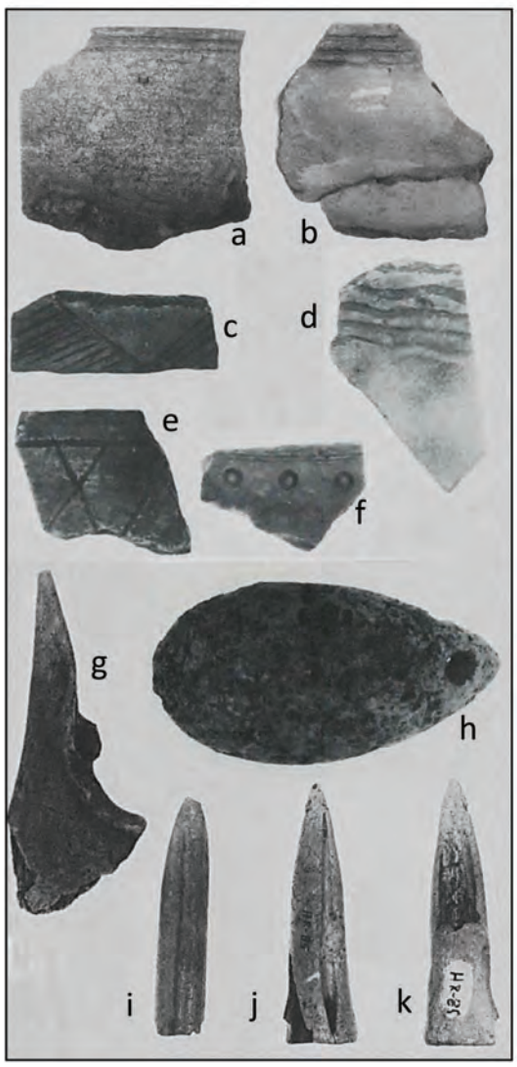



Figure 6.5. Items from the Fullen site (41HR82), location 1 in Figure 6.3. Items a–f = decorated pottery sherds; g = deer antler awl; h = stone fishing plummet with drilled hole; i-k = socketed projectile points made from deer bones. Photographs from O'Brien (1971), courtesy of the Texas Archeological Society.

The J. D. Wells site is a *Rangia* shell midden located on a low "pimple mound" adjacent to Cedar Bayou, at about its brackish water limit, as shown on the map (location 2, Figure 6.3). Pimple mounds are natural geomorphic features found on sandy loam. They are typically from 3 to 30 meters in diameter and 30 cm to 2 m in height (Robinson 2012), giving the shell midden occupants a platform slightly raised above the damp marshy terrain. It is a small site of the Early Ceramic through Late Prehistoric periods, and pottery sherds were found to be abundant, consisting mainly of simple "Goose Creek" sandy paste forms (more on ceramic types in Chapter 11). What were not found to be abundant were lithic artifacts, which are rare in many such coastal sites. At the Wells site, lithics were represented only by a Catahoula perforator, a Gary dart point, and a bifacial knife; very few lithic flakes were present, showing that point maintenance (mostly re-sharpening) rather than point manufacture was occurring. Oyster shells showed evidence of wear, indicative of use as scraping and cutting tools. *Rangia* shells were analyzed for season of harvesting in the method used by Aten (1981), where cyclical shell growth patterns are measured to specify the last season that a mollusk was still alive; the *Rangia* at this site appear to have been harvested in the warm months (May–August), similar to the range seen by Aten (1983) at other coastal sites (Patterson 1990c).

Numerous small shell middens of the coastal zone line are found along the Trinity River estuary and delta (location 3, Fig-

ure 6.3). Figure 6.6 shows an enlarged map of the lower Trinity River delta sites, with sites of shell middens shown from the project database, which in turn was compiled from the work of Aten (1983), Shafer (1966), and Ambler (1970). These sites date from the Late Archaic through Late Prehistoric periods, and most include ceramic sherds. Individual midden accumulations are typically less than 0.5 m thick but can be as thick as two meters or more (Figure 6.7); they are built upon river levees, fragments of old river terraces, and even on the marshy delta plain. The prominent north-south alignment of a number of middens on that map resulted from an archeological salvage operation in the 1970s, when there was a plan to build a dam and reservoir at the site. A north-south traverse was made to check for cultural artifacts before the area was to be flooded; the dam was never built. The dense distribution of middens along that traverse indicates how numerous middens are in the Trinity delta; those shown on the map are only the investigated tip of the iceberg.

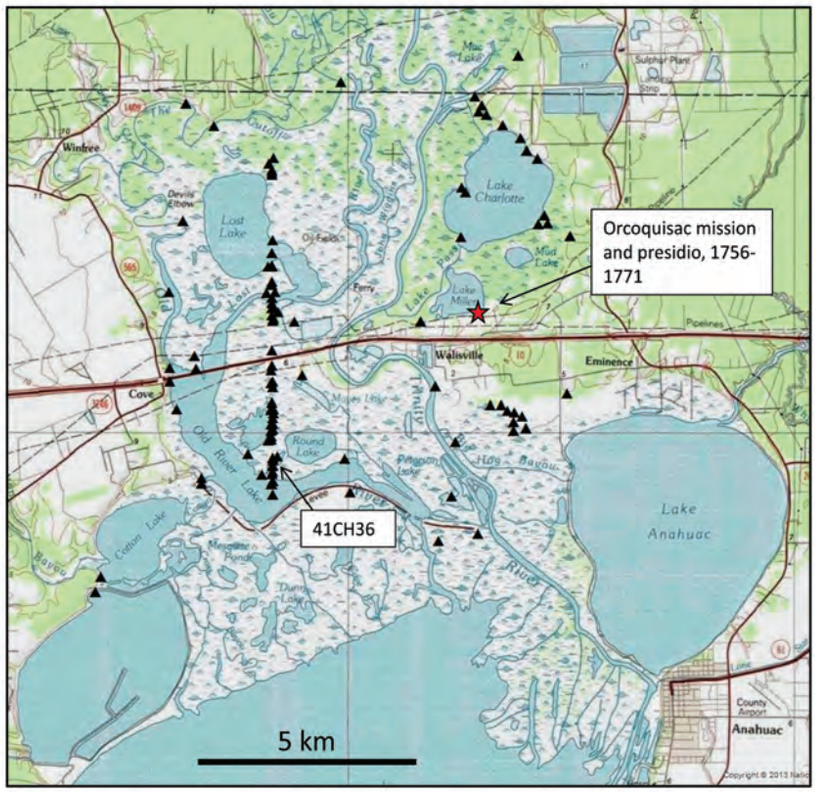



Figure 6.6. Archeological sites in the Trinity River delta (see Figure 6.2 for location). Triangles designate archeological sites, all of which are shell middens ranging from the Late Archaic to Early Historic periods. The prominent north-south line of sites resulted from an archeological salvage project; it demonstrates that shell middens are nearly ubiquitous in the delta area. Base topographic map from the U.S. Geological Survey.

Some of these sites extended into the early Historic Period, and an Akokisan presence was noted by Spanish visitors in the eighteenth century (see Chapter 4). The ill-fated Frenchman Joseph Blancpain's trading post of 1744 was located on the shore of Lake Miller (red star on Figure 6.6). After his arrest there in 1746, the Spanish built a short-lived mission and presidio named Orcoquisac (Akokisa) for the Native Americans living then there.

### Ages of shell middens in the coastal zone

There is a stark contrast in age ranges between those of brackish and marine shell middens—built by coastal dwellers for whom clams and oysters were a part of their diet—and those of "sand" (soil) middens found farther inland (Figure 6.8). Patterson (1989a, 1989b) separated shell middens (his "Coastal Zone") from "sand" or soil middens (his "Inland Zone") in his early database, and that distinction has been carried into the present project database. This age disparity is the result of continued rise in sea level along the coast (see Atlas I and discussion, Chapter 2), which continually brings sea water and brackish conditions in streams farther and farther inland over time. The contrast in age ranges between the two midden types can be seen by comparing Figures 6.8A and B. Shell middens range in age from Middle Archaic through Late Prehistoric (Figure 6.8A), although only two middens are as old as Middle Archaic—the rest are Late Archaic and younger. Site 41GV53 on Clear Creek, near its mouth at Clear Lake (location 1, both maps) contains both Early

Figure 6.7. A shell midden composed of R*angia cuneata* shells incorporated in a marsh of the Trinity River delta (41CH36, located on previous figure). Image from 1965, courtesy of Texas Archeological Research Laboratory, Austin.

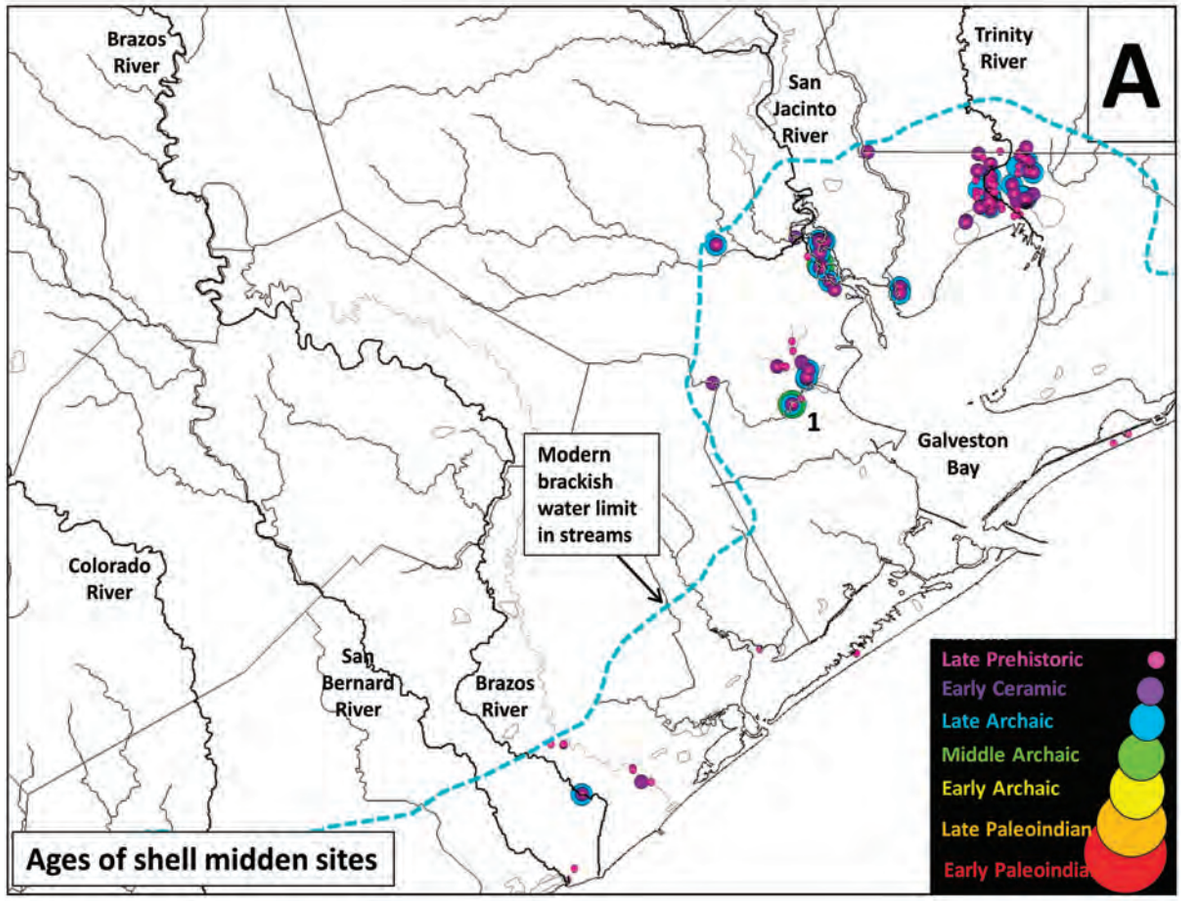
and Late Paleoindian points in a soil matrix, including Folsom, Early Side-notched, Angostura and San Patrice (Figure 6.8B). These soil strata at 41GV53, however, are overlain by a *Rangia* shell midden with radiocarbon-dated *Rangia* shells as old as 5,340 rcyBP (about 6,200 BP, or late Early Archaic Period) at its base, which is the oldest known shell midden in the region (Patterson et al. 2001). The overlying shell midden human artifacts there range from Middle Archaic through Late Prehistoric (Figure 6.8A). At this site, the arrival of rising sea water on the coast a few kilometers east of this site brought brackish water incursions and *Rangia* to the coastal streams in the immediate vicinity of the site, which are dated as the end of the Early Archaic and the beginning of the Middle Archaic. Older strata, which include Native American artifacts as old as Early Paleoindian, do not here include *Rangia*.

Shell middens occur in streams and rivers up to 12 miles inland on the low-lying delta (Patterson 1996), which approximately defines the present-day brackish water limit as shown by the dashed blue line on 6.8a. Marine and brackish water shell middens demonstrate the presence of brackish or marine water conditions in lower portions of streams along the coast during the period of Native American occupation. The limited and young age range of shell midden sites (Figure 6.8A) reflects the steady rise of sea level along the Texas coast, and this effect is regional in scope.

Native Americans were almost certainly living in coastal areas in the Early Archaic through Paleoindian periods, but are not in evidence at modern coastal shell midden sites. Sites of this older period are found both in soil middens in inland positions, and in coastal positions but at times before the (relatively recent) arrival of rising seas (see Figure 6.8B). Inland sites are not affected by the marine flooding of rising Late Pleistocene and Holocene seas, and hence contain a much wider range of ages that extend back to the earliest known time of occupation in the region. Shell middens of the older period were presumably located farther offshore and have been drowned by rising sea level. The sharp contrast between the age ranges of shell and soil middens can also be seen in the chronologic chart of Figure 5.12. An attempt to model the past locations of brackish water middens via paleogeography is presented in Chapter 10.

## Life in the coastal zone

The early nineteenth century observations of Colonel Graham (Dyer 1917; see Chapter 4) show that then-occupied middens on the lower Calcasieu River, being raised slightly above the level of surrounding coastal lowlands, were used as dwelling platforms by the village chief and the shaman. Patterson (2009) noted that most


A
Brazos River
Trinity River
San Jacinto River
1
Galveston Bay
Modern brackish water limit in streams
Colorado River
San Bernard River
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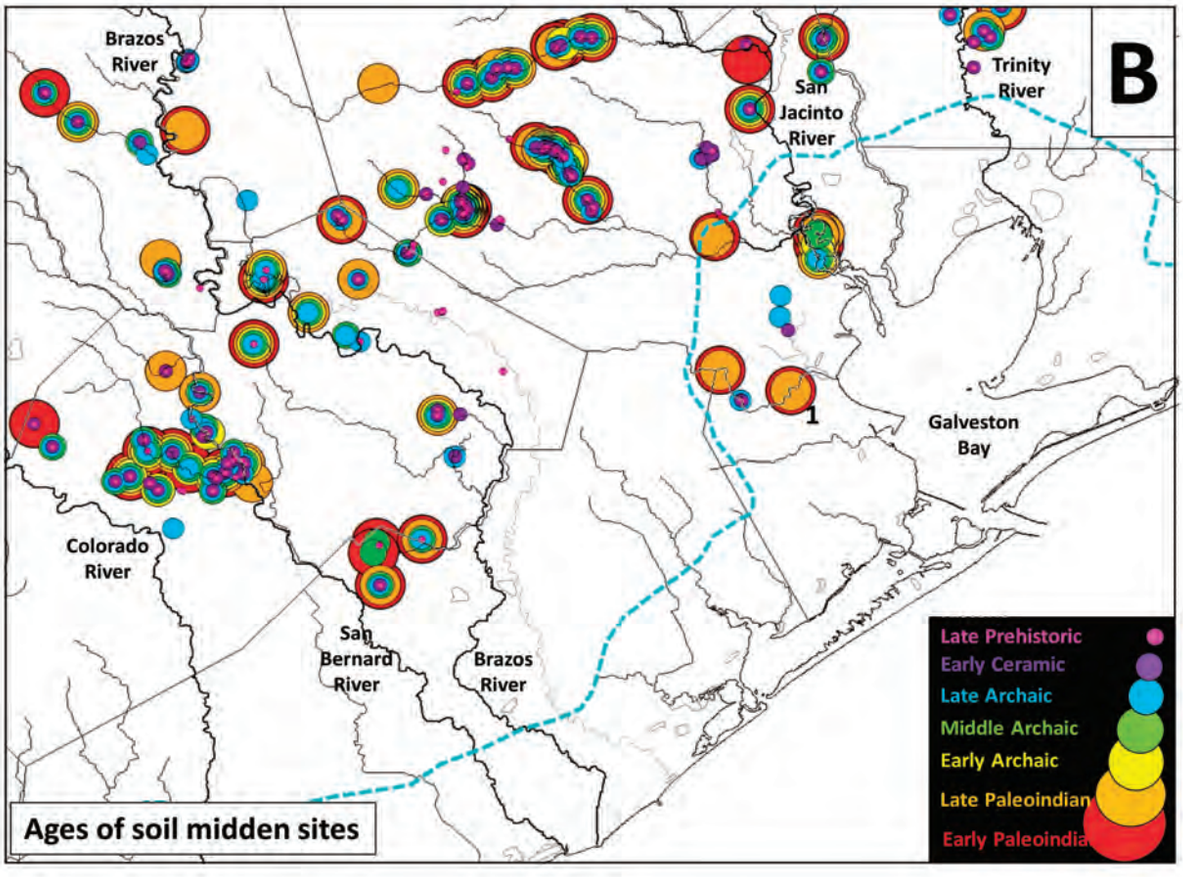
Late Prehistoric
Early Ceramic
Late Archaic
Middle Archaic
Early Archaic
Late Paleoindian
Early Paleoindia
Ages of shell midden sites


B
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San Jacinto River
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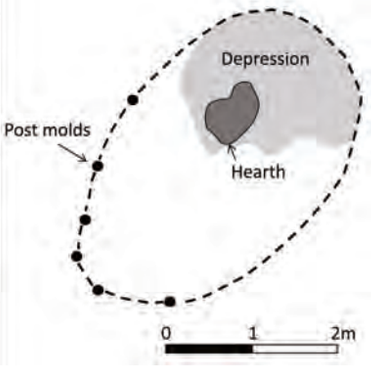
Galveston Bay
Colorado River
San Bernard River
Brazos River
Late Prehistoric
Early Ceramic
Late Archaic
Middle Archaic
Early Archaic
Late Paleoindian
Early Paleoindia
Ages of soil midden sites

Figure 6.8. Matrix materials of middens at archeological sites, with ages. A. *Rangia* and oyster shell middens and ages. B. Soil middens and ages, same area. Ages are color coded as per legend. Archeological period designations follow Patterson's 1996 chronol-ogy. Site number 1 is 41GV53, Clear Creek.

shell middens—which are basically oyster and *Rangia* shell refuse heaps—appear to have paved surfaces, and thus shells were not simply dumped. Such pavements—the result of carefully aligning shells horizontally, concave side down—often show evidence of being repaired several times at one site. Such shell pavements match Graham's observation that high ranking people lived on top of the middens. The rest of the encampment would be placed nearby, as middens are typically located on relatively high ground above stream and lake edges, on natural levees or pimple mounds. The Rivas-Iriarte expedition of 1687 encountered an abandoned village of "dome-shaped huts" on the shore of Galveston Bay. These were the skin-covered dwellings made of green sticks lashed together at their tops that were common to the Atakapa, Karankawa, and even the inland Tonkawa (Figure 4.11; also see artist's interpretation, Part III title page). The French mariner Jean Béranger landed on San José Island at Aransas Pass in 1720, and found a village of a dozen such "huts" inhabited by the Copano band of Karankawas, who lived there on fish, crabs and oysters. He noted that the dwellings were covered in animal skins, which could be folded like tents and carried away on the Indians' travels, a task that he said was left to women (Weddle 1991, quoting Wagner and Carroll's 1983 translation). Such dwellings could easily be erected on the midden pavements noted by Patterson. In other locations along the lower Gulf Coast, similar dwellings of other coastal groups were covered with palmetto leaves (Figure 6.9 lower).

At the Mitchell Ridge site on Galveston Island (41GV66, location 4 on Figure 6.3), a pattern of post molds in excavated soil at the site revealed an oval-shaped structure that had a central hearth (Figure 6.9 upper, from Ricklis 1994). The house measured 2.5 by 4.2 meters, and the post molds document the use of wooden, probably willow poles that held up the structures, which would have been covered in skins, as Béranger noted. The small hearth, measuring 76 by 24 cm, was lined with both oyster shells and pottery sherds, both of which were lying flat and hence purposely constructed, according to Ricklis. The sherds were oxidized to a bright red color by the fire in the hearth. Ricklis concluded that this particular house site was occupied for only a few weeks. Mitchell Ridge is not a shell midden site—it is built upon barrier island beach sand—but does have shell material in its refuse piles (Patterson et al. 2001).

Figure 6.9. Upper: an inferred Native American shelter site at Mitchell Ridge, 41GV66. A pattern of post molds in the excavated soil shows the size and oval shape of the former structure, which had a central hearth lined with oyster shells. The northeastern side of the structure is estimated. Modified from Ricklis 1994. Lower: a round Choctaw shelter covered with palmetto leaves, Bayou Lacombe, Louisiana. From Bushnell 1909.



Large shell middens also tend to contain pottery sherds, perhaps indicating that shellfish were being cooked on site. Moreover, pottery sherds are much more abundant in coastal midden sites than in inland sites, as demonstrated in Figure 5.3. This suggested to Patterson (1990b) that ceramics were primarily manufactured at coastal and river sites. In this interpretation, most vessels

would have been moved inland during seasonal migrations for prairie hunts, as discussed later. At the Mitchell Ridge site, the substrate on Galveston Island is mostly sand and shell hash, and clay supplies seem to have come from Pleistocene Beaumont clay outcrops on the mainland (Ricklis 1994), which indeed is the apparent source for most clay in the coastal zone (see geologic map, Figure 6.3).

Although *Rangia* and oyster shells are impressive in their numbers at coastal shell middens, they are not necessarily as important as other animal items in the Native American diet, neglecting plant items for the moment. Ricklis (2010) examined the food content of animal remains found in the shell midden at the McGloin Bluff Site on the shore of Corpus Christi Bay, a Late Prehistoric Karankawa coastal site. Surprisingly, he found that molluscs, represented in the archeological record by piles of shells, constituted only 2.3% of the meat weight of animal remains at the site. Fish, typically represented in the archeological record only as small otoliths (ear bones), represented 82.7% of the meat consumed, with mammals, including deer, bison, and small mammals, representing a distant second of 15%. The archeological significance of the shells is not in their food value but in their value as a marker of brackish water bay and stream conditions.

Lithic materials for making projectile points and tools are not found *in situ* in the coastal zone. The best source of large chert cobbles is in the Colorado River west of Eagle Lake, about 140 km from Galveston Bay. There were smaller chert and quartzite pebbles and small cobbles to be had in East Texas, as well as silicified wood, but at places in the Trinity and other river channels that were about 75 km inland from the coast (Chapter 9). As a result, shell and bone tools are much more abundant on coastal sites than inland, out of necessity, as is displayed on a map of the locations of sites with such tools (Figure 6.10). At Mitchell Ridge on Galveston Island (location 1), fish constituted 75% of the diet, followed by deer and cotton rats (Ricklis 1994). Bone-tipped arrows and spears were used for such fare (Figure 6.11). Aten (1983) reports that socketed bone points like those in the figure arrive in the "Late Preceramic" period (Late Archaic) and continue well into the Early Ceramic period, all along the upper coast; it would seem almost certain that earlier coastal dwellers likewise used bone tools, but their sites are now submerged. Aten also notes the use of blunt-tipped socketed bone points, presumably for bird hunting, where hunters wanted the carcass undamaged. Patterson and others (2001) report the occasional use of gar scales for arrow points.

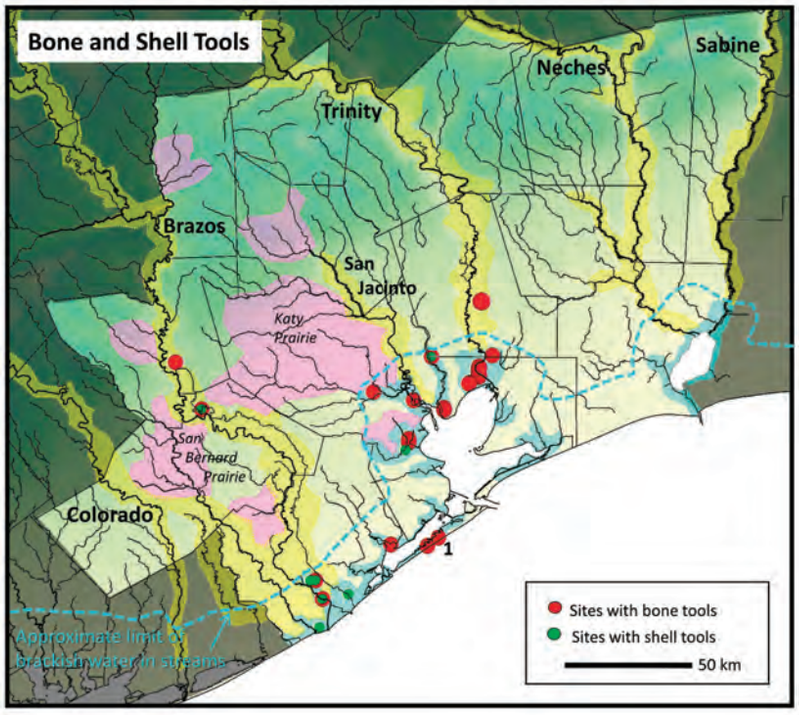



Figure 6.10. Locations with bone and shell tools, from the project database. Such tools are rare inland, where chert cobbles make better tool materi-al. Those sites shown along the inland Brazos River are related to shell ornament manufacturing; see Chapter 11 for discussion. Background shading depicts generalized topography.

There is little evidence for significant lithic manufacturing at midden sites, which are far removed from inland lithic procurement zones (Patter-

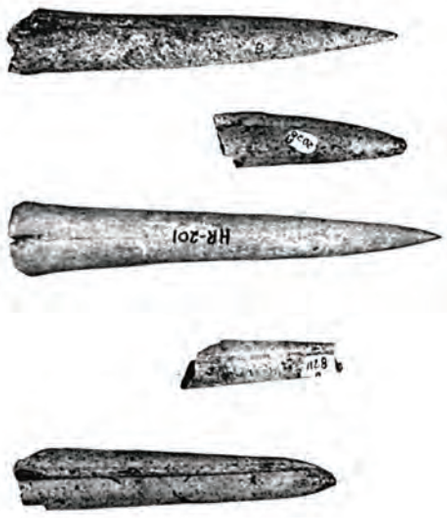


Figure 6.11. Socketed bone projectile points made from deer foot bones. Remnants of asphaltum hafting are present in three of these points (also see Figure 11.4). Fullen site, Armand Bayou (O'Brien 1971).

son 2009). At Mitchell Ridge, analysis of the sizes and characteristics of lithic flakes (generated during toolmaking) suggest that little unworked chert made it to the island (Ricklis 1994). Sandstone metates (grinding stones) are also typically absent, probably the result of distance from lithic source (Patterson 1996). However, arrow points (Late Prehistoric Perdiz and Scallorn points) are common, and are typically similar to those used in inland sites, strongly suggesting trade for these items or for their source material (Patterson 1996), as was indicated by Cabeza de Vaca's experience (Chapter 4). Aten reports that arrow points on the upper coast are typically made of chert, quartzite, and silicified wood, all materials that are available (at a distance) in rivers of the Southeast inland forests.

As the review of ethnohistorical accounts in Chapter 4 has established, the Akokisa were excellent swimmers and used dugout canoes. Spanish visitors noted that they fished with harpoons, bows and arrows, and with weir traps. Graham described the weirs in the abovementioned Atakapan coastal area: "Small lagoons, subject to tidal flow, were cut off by traps made of brushwood, in which the receding tide left behind numerous small fish." Descriptions of Native American weirs used in the early eighteenth-century Virginia colony were constructed of posts driven into waterways to funnel the fish into narrow zones where they could be speared or harpooned (Beverley 1705). Wooden weirs are not prone to preservation in our climate, but stone ones in the Fraser River of British Columbia date back to 4,500–5,280 BP, and in central Maine to 5,770 BP (Hirst 2018).

## Lifeway Zone 2: Fishing and hunting in river valleys

A second major lifeway zone for the Atakapa and their predecessors in Southeast Texas occurred in the valleys of the major rivers of the area: the Trinity, San Jacinto, Neches, and Sabine. These rivers transect broad river floodplains (Figure 6.12), incised during falling sea levels during the Last Glacial Maximum (Figure 6.12). As was discussed in Chapter 1, the drainage basins of these Southeast Texas rivers (as well as the drainage basins of the Calcasieu, Mermentau and Vermilion rivers of adjacent southwestern Louisiana) are small compared to those of the much larger Colorado, Brazos, and Mississippi/Red rivers that surround them (Figure 1.3). These small rivers, home to the various bands of the Atakapa during the early Historic Period, meander sluggishly through their broad river valleys. Small accompanying tributary bayous and creeks also inhabit the river valleys, making a quiet environment that was (and still is) perfect for fishing and for catching alligators and turtles—all major Atakapan foods. This setting can be characterized as a *refugium* – an ecological niche where human populations in the region were sustained throughout the long droughts that have occurred periodically during the Holocene Epoch. It is characterized by rich faunal and vegetal food resources, wood and other materials for fire and shelter, lithic and bone materials for tools and weapons, and above all a continual source of fresh water.

Of the Southeast Texas rivers, the Trinity contains both most of the archeological sites for which information has been published (Figure 6.1), plus by far the most

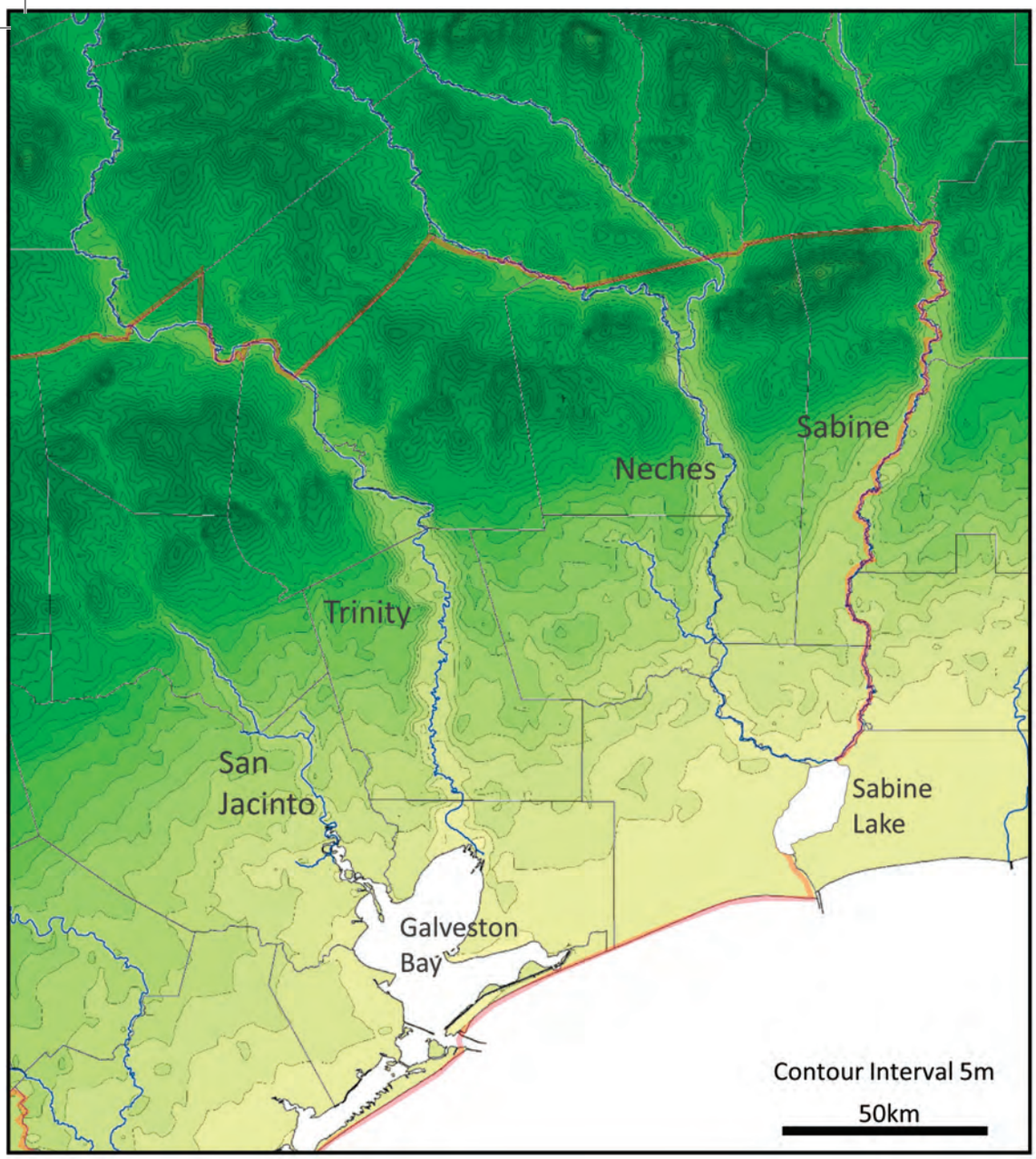
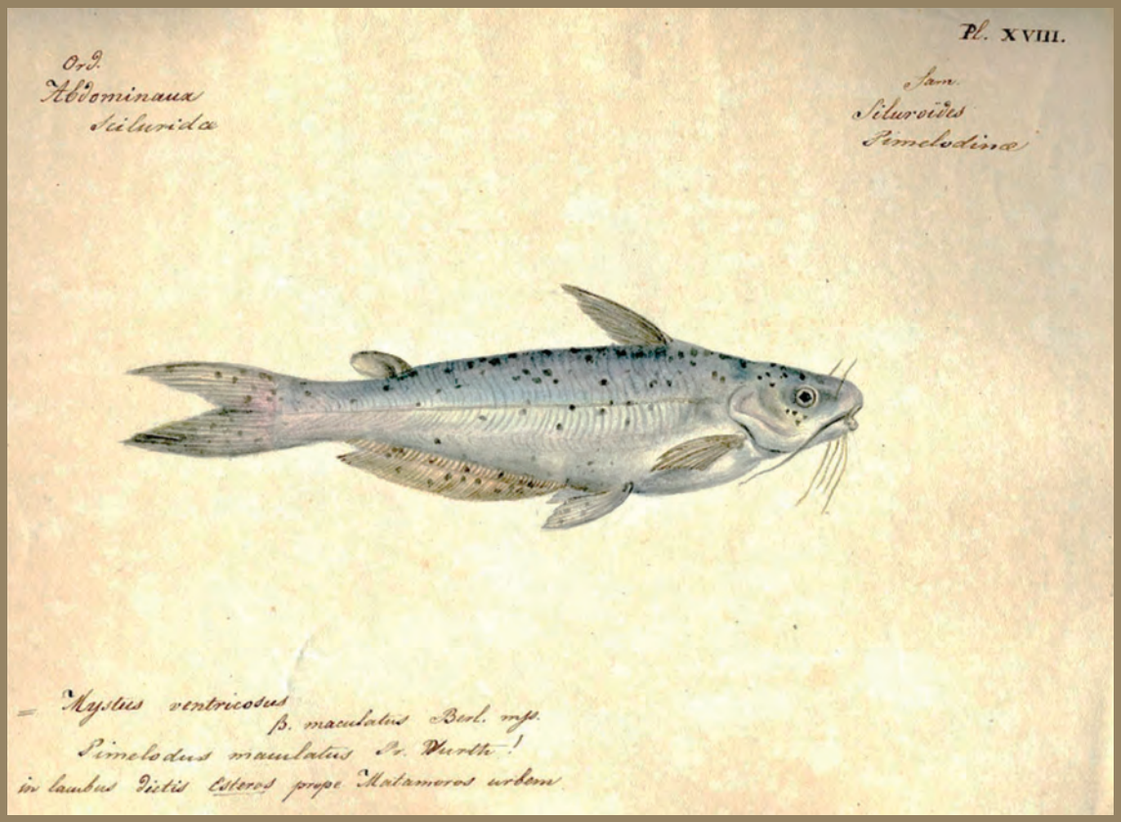
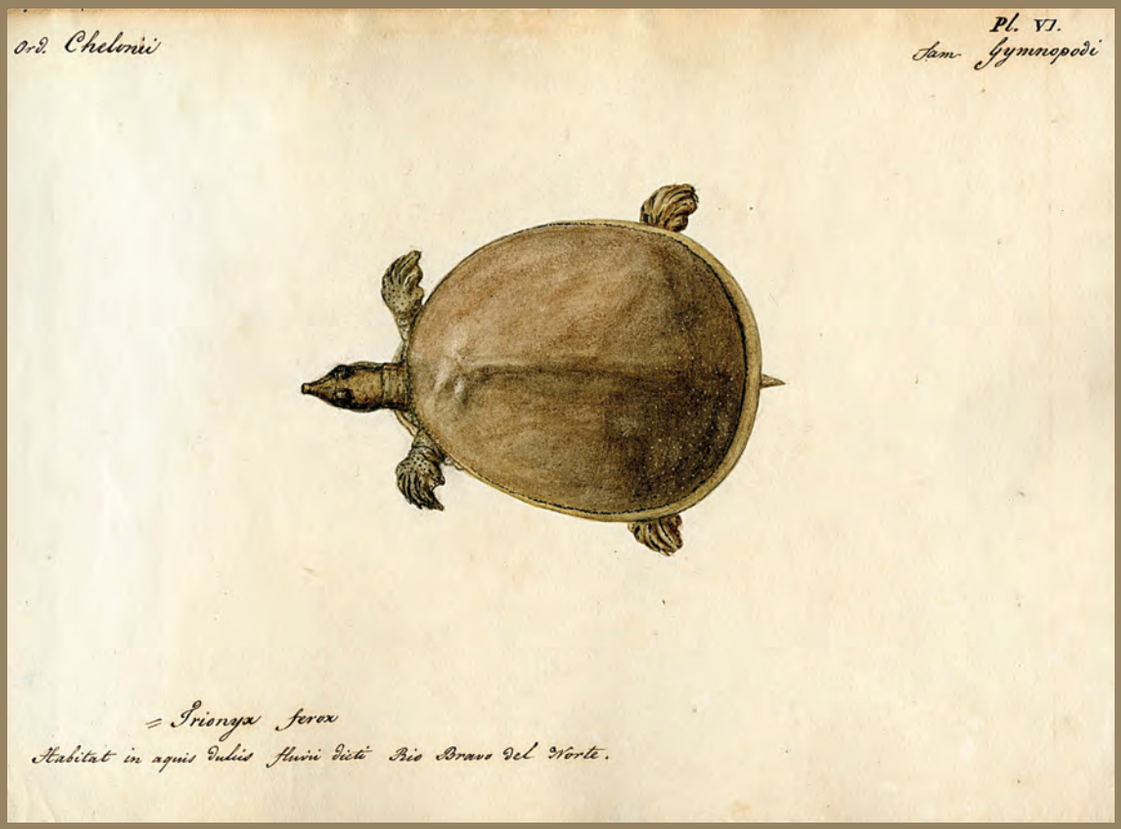



Figure 6.12 (left). Topography of Southeast Texas river valleys; note the broad incised valley floodplains of the Trinity, Neches and Sabine rivers. Red outline denotes project area boundary. Contour interval 5m.

Figure 6.13 (right). Riverine food re-sources. French naturalist Jean Louis Berlandier visited the Gulf Coast of Mexico and Texas in 1830, producing a folio of watercolor images of the fauna that he found. Upper: a catfish *(Pimelodus maculatus)*. Lower: an aquatic softshell turtle *(Trionx ferox)*. Such faunal resources sustained hu-man settlement along the Trinity and other Southeast Texas rivers for at least 13,500 years. Images courtesy of the Smithsonian Institution Archives.

ethnohistorical accounts of the Atakapan Akokisa and Bidai who lived there during the early Historic Period. A pair of closeup maps (Figure 6.14A and B) displays the lower part of the Trinity River, starting below Livingston and reaching the river's mouth in Trinity Bay. The floor of the valley consists mostly of young alluvium (Qal, Map A). The valley is bordered by an erosional valley wall, and surrounded by a higher, gently undulating prairie- and forest-covered surface that is underlain by the Pleistocene Beaumont (Qbs and Qbc) and Pliocene Lissie (Ql) formations. During the falling stage of the last glaciation, the valley was incised and filled several times, leaving behind within the valley a number of so-called Deweyville river terraces (Qd), which are higher in elevation than the adjacent river alluvium (see Figures 6.14a and 2.13). Native American encampments and villages, as evidenced by archeological sites, typically were placed on the slightly raised Deweyville terraces, keeping them close to the river but comfortably above it. In 1756 a band of Akokisa led by Chief Calzones Colorado were living on such a raised Deweyville terrace above the floodplain (location 5, Figure 6.14A). The abovementioned French trading post and later Spanish mission and presidio at Orcoquisac is located at 6


Pl. XVIII.
Ord.
Abdominaux
Siluridæ
Fam.
Siluroïdes
Pimelodinæ
= Mystus ventricosus
β. maculatus Burl. mss.
Pimelodus maculatus Pr. Wurtb.!
in lacubus Ditis Esteros prope Matamoros urbem


Ord. Chelonii
Pl. VI.
Fam. Gymnopodi
= Trionyx ferox
Habitat in aquis Ditis fluvii dicti Rio Bravo del Norte.

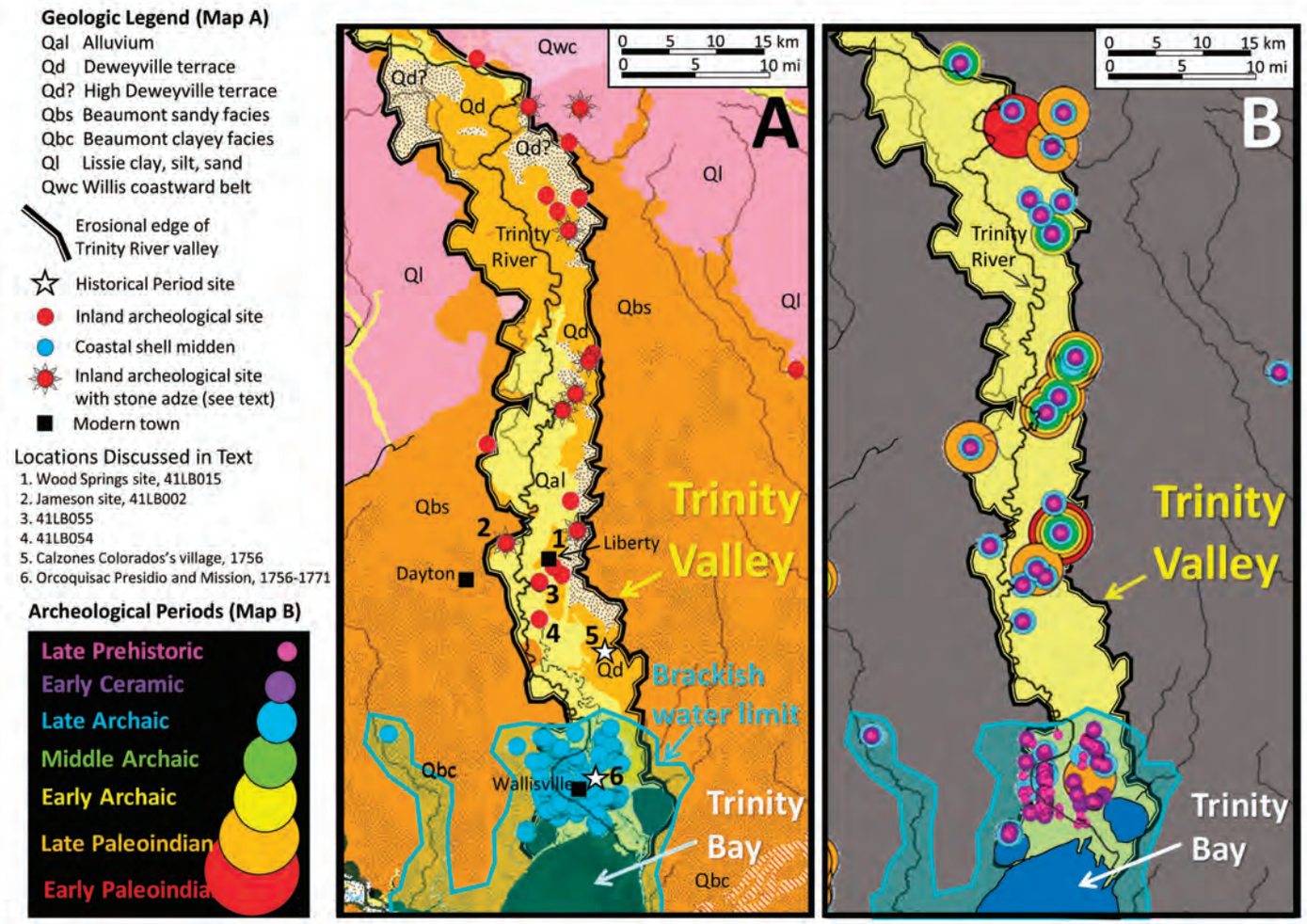



Figure 6.14. A map of the lower Trinity river valley and estuary, in Chambers, Liberty and southern Polk counties. A. Surface geology and loca-tions of archeological sites. B. Ages of archeological sites. The geology is adapted from the *Geologic Map of Texas* online, U.S. Geological Survey. Map location is shown in Figure 6.2.

and was not on such a terrace; infested by mosquitos and prone to flooding, it was abandoned in 1771 (Bolton 1970 [1915]).

Inland Trinity river valley archeological sites display a broad range of ages from the Early Paleoindian through Late Prehistoric periods (Figure 6.14B). Three sites are as old as Early Paleoindian, and Clovis points have been found at the Wood Springs site (41LB15, location 1 on Figure 6.14A; Crook et al. 2017). Starting in Middle Archaic time, the number of discovered archeological sites increases, with the largest number of sites representing the Late Archaic through Late Prehistoric periods. This late increase in numbers of sites is general throughout the Southeast Texas region, and has been inferred to be due to an increase in population (Patterson 1996). The broad age range of inland sites contrasts very sharply with sites in the immediately adjacent Trinity delta of the coastal zone, which range only from Late Archaic through Late Prehistoric (Figure 6.14B), as already discussed. Possible older archeological sites in the delta area are buried beneath young Holocene delta sediments.

Most of the sites along the Trinity were described from surface collections, especially those with artifacts housed in the Kyle collection at the Sam Houston Regional Library and Research Center in Liberty (Crook et al. 2017). Surface collections result from lithic artifacts found on the surface as opposed to in an archeological excavation. In many cases, midden soil has been eroded ("deflated"), leaving

Figure 6.16. A Seminole family in a dugout canoe, Florida, early twenti-eth century. Courtesy of the Library of Congress.

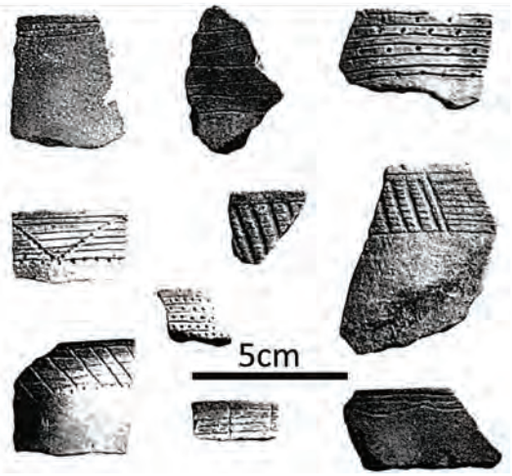



Figure 6.15. Examples of Goose Creek incised pottery sherds from the Jamison site (41LB2); see Figure 6.13A for location. Photographs from Aten (1967).

little but lithic artifacts on the surface as a "lag" that was not as easily moved by the elements as the remainder of the soil. However, the Jamison site (41LB2; location 2 on Figure 6.14A) is stratified and was excavated by Aten (1967). The site rests about 2 km from the Trinity River on a high Deweyville terrace; faunal remains suggest that its residents hunted both in the adjacent uplands and in the flood plain. The Jamison site faunal remains contained a large number of deer bones, typically represented by long leg bones, suggesting that the animals were butchered at kill sites and then brought to camp in quarters. About 1,400 ceramic sherds were collected, mostly of the Goose Creek style. Figure 6.15 shows examples of the rim designs in sherds of the "Goose Creek Incised" style (most sherds found however, were unadorned "Goose Creek Plain"). Bowls and jars were used for holding water, cooking, and food storage.

Based upon the occurrence of artifacts like Ellis and Gary lithic points, sandy-paste Goose Creek and grog-tempered San Jacinto ceramics, and various arrowhead points, Patterson (1996) concluded that the Jamison site showed occupation from Late Archaic through the Late Prehistoric Period. Several rectangular gouge-like tools were described that might now be considered woodworking adzes (see later discussion). Other tools included knives, gravers, a hammerstone, and utilized flakes. Red ochre powdered pigment as well as transported hematitic sandstone (probably an unground source of the pigment) were present. Asphaltum, a tar imported from the coast, was found coating the bases of several lithic points, suggesting its use in hafting points to wooden shafts. A very large number of fired clayballs (11,000 round lumps of fired clay) were found that showed evidence of proximity to cooking in hearths. The use of clayballs in pit-cooking is discussed in Chapter 8.

### Canoes and boatbuilding

During the Early Historic Period the lower Trinity River (Chambers, Liberty, and southern Polk and San Jacinto counties) was home to the Akokisa, whereas the terrain farther upriver was the home of the Bidai (northern Polk and San Jacinto counties as well as Walker, Trinity, Madison, and Houston counties); both were part of the Atakapa cultural group. In June 1748 Spanish soldier Orobio Basterra observed Akokisa people on the lower Trinity using log canoes and making nascent efforts to grow a type of corn, a practice that may have been learned from their neighbors to the north, the Caddo:

*On the 10th of June . . . I arrived at the River of the Most Holy Trinity, where . . . I made camp. Having the men laboring to facilitate the crossing, we were saved from the effort when we happened to spot Indias* [women] *for the Horcoquiza* [Akokisa] *Nation that were from the ranchería that is at the mouth of the aforesaid river at its eastern side* [the village of Calzones Colorado, location 5 on Figure 6.14A; village location from Woodrick and Linton 2009]. *They went to give word to the Indian chief. The lat-*

> *ter, on the 11th, came to my camp with four canoes and a few Indians. . . . He begged me to* [get in the canoe with them, loaded the other three canoes . . . and headed to the village]. . . . *I met with some of the Indian leaders, including their chief, to see their croplands of corn, which are so small and their irrigation so contingent, that they cannot be appreciated. And these Indians finish* [eating] *them while the grain is still tender and thus the corn, as the crop they saw there, they consume in a period of two weeks* (Woodrick and Linton 2009).

The dugout canoes that Orobio Basterra saw were commonly used both in the coastal region and in the inland rivers throughout the southeastern United States, and were used by the Seminole Tribe of Florida into the twentieth century (Figure 6.16). Cabeza de Vaca noted a number of log canoes in use at Follett's Island by coastal Coco and Atakapans in 1528 (Weddle 1985). Bellisle noted numerous such dugout canoes in use by Atakapa at the mouth of the San Jacinto River in 1720 (Weddle 1991). Berlandier noted a fleet of dugout craft in Aransas Bay in 1720, owned by Karankawa. He described the craft as well built and large enough "to carry a dozen casks placed end to end." Observing their method of construction, he noted that live coals were placed along the length of the log, and charred wood was then removed with specially made bone knives (Weddle 1991). The same technique was observed in colonial Virginia and was drawn in 1590 by Theodor de Bry from a watercolor by John Witte (Figure 6.17, from de Bry et al. 1590). Recently, a 33-foot log boat dating to the 14th century AD was recovered along the Red River, in what was Caddo territory in Early Historic time (Girard and McGimsey 2019). The boat had step-like seats carved in both ends, which allowed the boat to be used for going in either direction; thus there was no need to turn it around in narrow river and bayou channels.

Although wood artifacts, such as those used in constructing canoes, do not preserve well in the southeastern climate, a number of boat-related artifacts were found in a bog along the Gulf Coast of Florida (Cushing 1896). Woodworking tools were represented by a significant number of adzes of various types, two of which are shown in Figure 6.18. One is a conch shell adze, a replica of which was found to be effective by the archeologists. A second adze was made of hardwood with an ingenious socket made of deer horn, and an inset shell cutting face. Southwestern Florida is far from lithic sources, so shell was used for cutting edges. The cache also contained small model canoes showing the form of dugout boats, and a full-sized hardwood paddle that was found adjacent to a rotting canoe. Ceramics were found at the site, as were a number of atlatls but no bows and arrows, suggesting an Early Ceramic Period age; radiometric dates of the wood suggest an age of 55 to 850 AD, the earlier portion of which

Figure 6.17. Native Americans making a dugout canoe, 1590. From a copperplate engraving in de Bry and others (1590). Image courtesy of the Library of Congress.

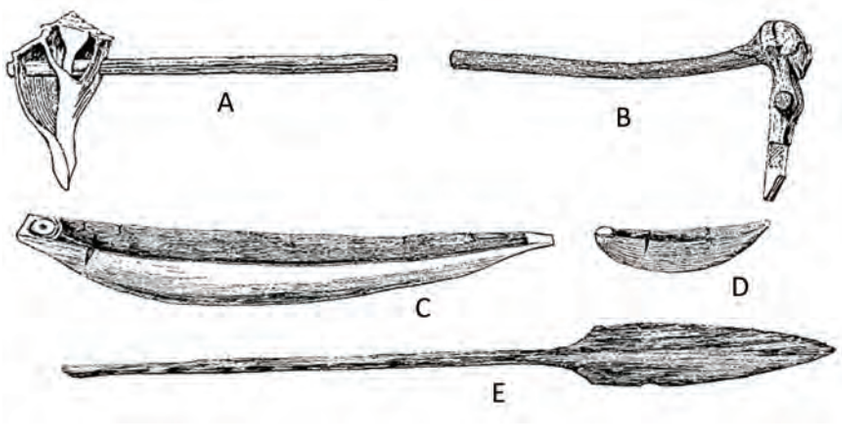



Figure 6.18. Late Prehistoric to Early Historic wooden and shell artifacts related to construction and use of boats, from Key Marco excavations, Florida Gulf Coast (Cushing 1896). A = Conch shell adze or gouge with wooden handle, length 15 inches. The conch was originally secured with rawhide strips, largely deteriorated by the time of excavation. B = Adze of hardwood, with deer horn socket and an inserted bit made of shell, length 12 inches. C, D = Model canoes (possibly toys) that display the form of dugout canoes. Canoe C is about 20 inches in length. E = Hardwood paddle, with end burned off. Found adja-cent to the gunwale of a rotted canoe.

is consistent with the later part of the Early Ceramic Period in Texas (Brown 2014).

A number of sites along the lower Trinity River show evidence of woodworking that likewise may be related to the former building of log canoes. The East Fork tool is an adze-like "gouge" that was found by Crook and Hughston (2007) in Early Archaic sites along the East Fork of the Trinity River (Figure 6.19). Hudler (1997) and Crook and Hughston (2007) examined groups of these tools and subjected them to use-wear analysis, concluding that they were used as bits in woodworking adzes, much like the shell cutting bit in the adze shown in Figure 6.18. Some of these tools were found at the Wood Springs site (41LB15; location 1 in Figure 6.14A; Crook et al. 2017). In Southeast and East Texas, a variant of the Texas adze tradition, the Harvey (Mineola) Biface, has recently been described by Crook (2018). The tools are nearly all made from slabs of silicified wood, one of the few lithic resources in the area, and have been found at a number of sites close to the Trinity River (Figure 6.14A; these sites with such bifaces are marked with a "sunburst" symbol). Typically, the tools have a blunt hafted edge at one end, and a chipped, straight working edge at the other; straight lateral edges are blunt (Figures 6.20 and 6.21). Microscopic analysis of polished and fractured working edges by Crook led him to conclude that these, like the Clear Fork tools, are cutting bits for stone adzes used in woodworking. Noting the proximity of the tools to the Trinity River, he suggested that the tools—of Late Archaic age—were used in the construction of log canoes. As with the East Fork tool, the bits would have been inserted into the end of a wood and bone tool handle.

Hundreds of prehistoric dugout log canoes have been found preserved in Florida's swamps and marshes. In some cases it appears that the owners had deliberately buried them to hide them, and then never returned. The oldest such canoe yet found was dated at 7,000 BP, Early Archaic Period (Laskow 2017), the same age as the East Fork woodworking tools found along the Trinity River.

Figure 6.19. Examples of East Fork Biface hafted woodworking tools from the Wood Springs site (41LB15; location 1 on Figure 6.13A). Photos courtesy of Wilson W. Crook Jr.

Figure 6.20. Examples of Harvey (Mineola) hafted woodworking tools from the Wood Springs site (41LB15; see location 1 on Figure 6.13A). Photos courtesy of Wilson W. Crook Jr.

Figure 6.21. A drawing of a Harvey-Mineola Biface tool from the Wood Springs site (41LB15; location 1 on Figure 5.4A). Illustration by Dr. Claudia Penati, courtesy of Wilson W. Crook Jr. Scale is in centimeters.

## Diet and daily life

In general, the diets of the residents of inland rivers and streams were surprisingly similar to those of the 12-mile-wide coastal zone. Patterson (1993) prepared a comparative count of faunal remains from sites in coastal versus inland (mostly river- and stream-based) environments (Figure 6.22). The chart, from information within reports from the locations within the project database, shows occurrences of both terrestrial and aquatic fauna. The incidence of terrestrial deer and small animals (turtles, raccoons, rabbits, snakes, opossums, etc.) are quite similar, as are aquatic alligators, turtles, catfish and the like—except that the coastal environment has the added advantage of oysters, *Rangia*, and several varieties of bay fish. Forested river bottom land offered much in the way of floral materials as well, including pecan, oak and hickory nuts, berries, paw, and persimmons. The Marqués de Rubí, in his 1767 transect of Bidai and Akokisa territory along the Trinity River, observed that Native American contentment in living on such abundant vegetal fare "made them lazy," and that they did not seem to take advantage of the area's deer, bison and bear, although he did observe them harpooning fish. He also noted their practice of lassoing alligators by the snout and dragging them ashore—presumably not too lazy an enterprise (Weddle 1995)!

The wide variety of small mammals consumed, as evidenced in the chart, raises the question of how the smaller animals were caught. Large mammals, such as deer and bison, were presumably felled with atlatls before the introduction of the bow and arrow. That latter technology appeared in Galveston Bay and the Sabine Lake areas at about AD 500 (Aten 1983). Bow and arrow technology could take down both large and small mammals. Small mammals could be snared and trapped, but hard evidence of this from archeology is lacking. Southeastern tribes are known to have used darts from blowguns to hunt small game well into modern times; Swanton (1946) documented their use by neighboring Chitimacha, Houma, and Natchez Indians, as well as—only slightly farther afield—Choctaw, Creek, Catawba and Cherokee (the geographic locations of most of these groups are shown in Figure 4.1). In most of these cultures, blowguns were primarily used by children. Lieutenant Timberlake (1754) noted this weapon's use among the Cherokee as follows:

> *There are a vast number of lesser sort of game, such as rabbits, squirrels of several sorts, and many other animals, beside turkeys, geese, ducks of several kinds, partridges, pheasants, and an infinity of other birds, pursued only by children, who,*

Table 1. Summary of Terrestrial Faunal Remains

| type | inland sites | coastal margin sites |
|---|---|---|
| deer | 39 | 38 |
| land turtle | 37 | 11 |
| snake | 9 | 8 |
| rat | 8 | 8 |
| land bird | 11 | 6 |
| bison | 17 | 8 |
| rabbit | 15 | 11 |
| gopher | 11 | 4 |
| skunk | 3 | 3 |
| mouse | 5 | 3 |
| raccoon | 6 | 6 |
| opossum | 10 | 6 |
| badger | 2 | 0 |
| antelope | 4 | 0 |
| squirrel | 3 | 3 |
| beaver | 5 | 0 |
| bear | 1 | 2 |
| mink | 1 | 0 |
| muskrat | 0 | 3 |

Table 2. Summary of Aquatic Faunal Remains

| type | inland sites | coastal margin sites |
|---|---|---|
| mussel | 25 | 0 |
| alligator | 10 | 11 |
| water bird | 5 | 8 |
| water turtle | 9 | 23 |
| gar | 15 | 26 |
| misc. fish | 11 | 22 |
| frog | 8 | 3 |
| catfish | 9 | 16 |
| drum | 9 | 15 |
| bass | 4 | 0 |
| bowfin | 7 | 5 |
| sunfish | 4 | 0 |
| Rangia | 0 | 200+ |
| oyster | 0 | 23 |
| shark | 0 | 1 |
| redfish | 0 | 1 |
| sea trout | 0 | 4 |
| sheepshead | 0 | 5 |

Figure 6.22. Faunal remains of inland vs. coastal sites in the Patterson-HAS database (as of 1993), from Patterson (1993).

*at eight or ten years old, are very expert at killing with a sarbacane, or hollow cane, through which they blow a small dart, whose weakness obliges them to shoot at the eye of the larger sort of prey, which they seldom miss.* (Timberlake et al. 1765)

Speck (1938) recorded that Catawba men in the early twentieth century (in North Carolina) remembered the use of such a weapon in securing birds for cooking. A blowgun and darts was collected by Swanton (1911) from the Chitimacha of southern Louisiana, who lived adjacent to the Atakapa. It would seem likely that the Atakapa also used them, but there is no ethnohistoric documentation of that.

## The Brazos and Colorado River Valleys

The Brazos and Colorado are both much larger rivers than the Trinity, and both drainage basins reach deep into central Texas and, in the case of the Brazos, into the Rocky Mountains (Figure 1.3). These rivers, like the Trinity, each have a broad floodplain in a low valley surrounded by higher Pleistocene prairies. The relative depth of each valley floodplain diminishes as the valley nears the sea. Each floodplain is underlain by Quaternary (Holocene) alluvium, and the rimming prairies are part of the Pleistocene Beaumont and Pliocene Lissie formations. Brazos and Colorado river water is typically cloudy as a result of their high sediment load, but the sluggish, quiet back creeks elsewhere in the floodplain are clearer and make for better fishing. The Brazos valley floor was originally forested, but trees were removed by Anglo immigrants in the 1820s in order to cultivate cotton (Chapter 3). Nonetheless, a large number of old growth pecan trees were allowed to remain for their nut production, and are still present. Removed trees would have included elm, hackberry, oak, and other varieties still found locally.

Figure 6.23. Catching an alligator using a lasso, on the Madeira River in the Amazon rainforest. From Keller, 1875.

There is a significant difference in the setting of early Native American occupations along the Brazos versus that of the Trinity and Sabine-Neches rivers. Those latter rivers transect the East Texas Pineywoods and Big Thicket forests, and sites outside the immediate vicinities of those rivers (i.e., beyond the floodplain and surrounding river terraces) are very sparsely located indeed (Figure 6.1). In contrast, the Brazos River and its associated sites

are surrounded by prairies that are teeming with prehistoric hunting sites with long occupation sequences that lie along small creeks, which are described in Chapter 8. Archeological sites in the Brazos valley tend to be along the valley rim or along small associated creeks. The human use of the creeks in the Brazos floodplain and in the creeks of the surrounding prairies was seemingly identical; they were seasonal hunting camps with an overlay of fall nutting activities. For this reason, this area is discussed in Chapter 8 along with the adjacent prairie hunting zones. In addition, the lower Brazos and Colorado river area was host to a peculiar Late Archaic "Lower Brazos Culture" that is defined by large mortuary sites containing grave goods from exotic locales in central Texas, the Ouachita Mountains of Arkansas, and even from the Great Lakes region; those Late Archaic burial sites and the culture that produced them are discussed in Chapter 11.

# 7.

# Projectile point traditions and bison hunting

Leaving behind the forested riverways of Southeast Texas, and the marshy lowlands of the coast, we enter a quite different third major Native American lifeway zone of inland prairies, a place known in ethnohistoric accounts of communal bison and deer hunting (Chapter 4), and where evidence of such hunting can also be found in archeological sites (Figure 7.1). It is an inland area that in ancient times comprised broad tallgrass prairies transected by numerous small streams with accompanying narrow riparian (riverine) forests. We focus here on the two largest prairies in the area. The Katy Prairie occupies a corridor in between the once forested Brazos River floodplain and the eastern Texas forest. It is drained by the uppermost tributaries of the San Jacinto River, in particular Buffalo Bayou (including its tributary, White Oak Bayou) and Cypress Creek, a tributary of Spring Creek. The San Bernard Prairie occupies an upland corridor in between the once forested Colorado and Brazos river floodplains. In these two prairie areas, bison and deer hunting were the major reasons for a periodic Native American occupation that began at least by Early Paleoindian time.

We will look at these inland prairies from two levels. In this chapter, a satellite-level "landscape archeology" view of the eastern half of Texas focuses on projectile point typology as an approximate indicator of who was hunting in these prairies over time. Archeological sites contain projectile points that come from a very broad region, including points that typically are found in Central Texas and are made of

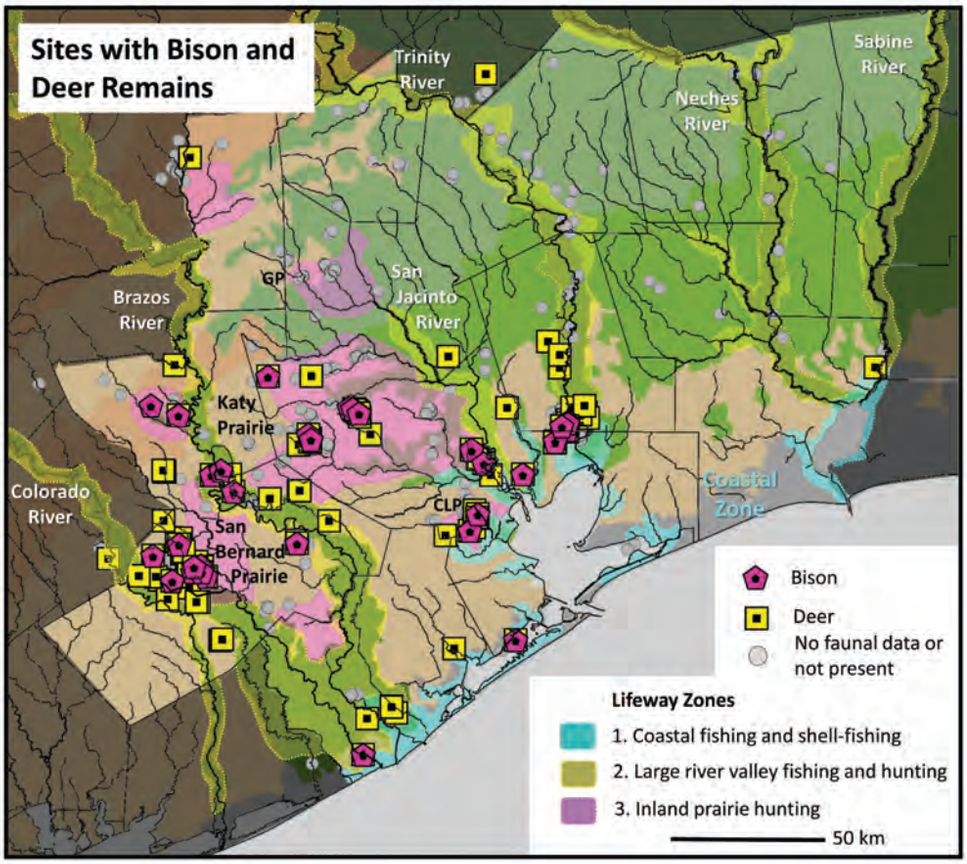



Figure 7.1. Map of archeological sites with bison and deer remains, overlain on map of lifeway zones, shaded in semi-opaque pink, yellow, and blue. The shaded underlay depicts ecoregions, as defined in Figure 3.7. CLP = Clear Lake Prairie.

the Edwards Formation chert from that area; points from the eastern Texas forested rivers made from chert and silicified wood local to that region, and even points from locations in northeast Mexico and South Texas. To sort out which cultural groups were hunting here and when, we need to look at the projectile points in these prairies from a high level, nearly statewide view. In the following Chapter 8, we will delve into the ground level details of prairie archeological sites to learn more of how hunting was carried out, as well as other details of everyday life in the inland prairie lifeway zone.

## Introduction

The prairie lifeway zone of the Southeast Texas project area has been occupied by Native Americans since at least the time of Clovis technology, beginning at approximately 13,500 BP, and that occupation extended into the Historic Period with Akokisa and Bidai (Atakapan) and Coco (Karankawan) groups. It has also long been a place of bison and deer hunting. Spanish and French accounts of the early Historic Period describe communal hunting of both bison and deer in these prairie areas, and many archeological sites show evidence of such hunting, including bison and deer bones (Figure 7.1), butchering tools, and hearths.

In Southeast Texas, bison remains are most typically found in this inland prairie setting or along the coastal prairies, rather than within the East Texas forest and its river valleys. Bison are plains animals, and not prone to deeply penetrating thick forests, hence their general absence from Big Thicket and Pineywoods sites in this region, at least so far as scant faunal data there attest.

The distribution of bison remains suggests that bison entered the area from the interior Texas plains, traveling through the Katy and San Bernard prairie to the coast, where they spread out in the lush coastal grasslands. Studies by Dillehay (1974), Collins (2004), Collins and others (2011), and Lohse and others (2014) have shown that bison, found primarily in the northern and southern Great Plains, come farther south into Texas only periodically, in relatively long-term pulses over centuries and millennia, apparently when climatic conditions are *mesic* (wetter), allowing tall grass to grow more plentifully than plains short grasses, which thrive in a *xeric* (drier) climate. Huebner (1991) posited that paleoclimatic changes coaxed bison southward in a "bison corridor" that brought bison from the southern Great Plains into the prairies of the Southeast and central coast.

Historical accounts discussed in Chapter 8 show that bison in north-central Texas also moved seasonally on a much shorter, annual basis, moving south during the fall as they prepared for a time when winter freezes wither inland grasses but green grass still thrives along the coast, around Galveston and Matagorda Bays, for example. The Katy and San Bernard prairies, as can be seen in Figure 7.2, form natural bottlenecks along their route, as the San Bernard prairie lies in a southeastward-narrowing zone in between the then-forested lower Colorado and Brazos rivers, and the Katy prairie lies in a constriction between the Brazos and the western arms of the eastern Texas forest. Native Americans devised successful harvesting strategies in these natural bottlenecks that were used for thousands of years. Evidence from archeological sites shows that the hunters were not only local groups from the adjacent Southeast Texas coastal zone and forest but also groups from Central Texas as well as from the Central Coast–South Texas region. The evidence for this lies in the types of projectile points found at Katy and San Bernard prairie sites.

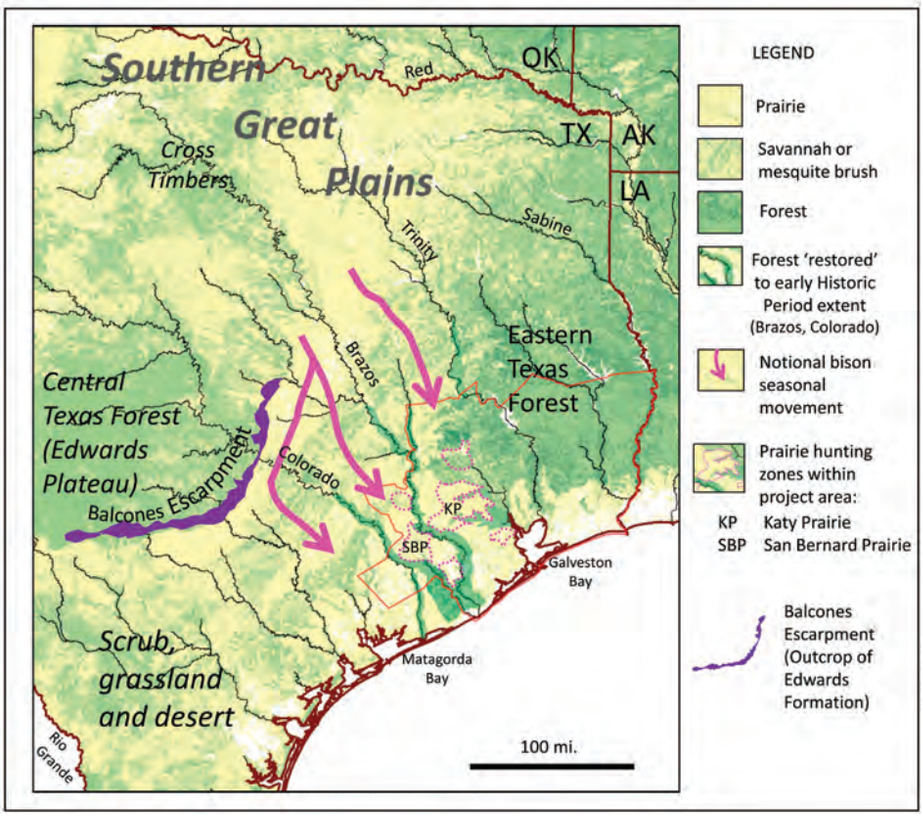



Figure 7.2. Regional index map showing the setting of the Katy and San Bernard prairies. Areas highlight-ed with dotted pink lines outline the prairie lifeway zones shown in Figure 7.1. Heavy pink lines show hypothesized routes of fall and early winter bison movement. Base map displays areas of modern forests, from Wilson and others (2013), U.S. Forest Ser-vice. Intensity of shading represents total forest carbon stocks, correlating in general to intensity of forest cover. Green shading has been added along Trinity, Brazos and Colorado rivers to represent areas originally forested that now appear as grassland or crop-land on the Forest Service map (see Chapter 3). In like manner, shading has been added at Buffalo Bayou and Cypress Creek, where dense urbaniza-tion obscures original forested extent.

As mentioned, bison populations in Texas are thought to have been largely dependent upon moisture, which in turn affected the abundance of grass. Wet times favored bison abundance in Texas, and dry times did not. Collins and others (2011) examined Central Texas projectile point types through time and noted a broad correlation of point types and bison abundance, noting that "our findings reinforce earlier suggestions that large, broad-faced projectile point forms were specifically designed for use in killing bison" (Collins et al, 2011, referring to work by Bement et al. 2005; Dial et al. 1998; Wyckoff 1995). They made generalized maps of Central Texas point styles, following earlier work by Prewitt (1995), and associated them with climatic intervals. Detaching point types from the idea that they were products of individual ethnic groups, and instead considering them as functional forms that could be more widely dispersed, they looked at the effects of broad climatic changes that seemed to track changes in point styles, within the limitations of nascent and imperfectly understood Texas paleoclimate data. Their study was intended to stimulate further research interest in the topic.

More recently, Lohse and others (2015) refined radiometric age dating of bison remains younger than 6,000 BP in archeological sites in Texas and Oklahoma, and his results reinforced the idea that bison abundance was related to climatic conditions. In addition to refining local and regional chronologies:

> *our findings. . . contribute to hypotheses about fluctuations in "Plains-like" cultural patterns that depended, in part, on environmental and climatic change and the subsequent exploitation of bison for subsistence and economic purposes. For example, what appears as the sudden onset of bison-related cultural patterns, especially Calf Creek and Toyah, may have been associated with rapid climate change (Mayewski et al., 2004). . . . Additionally, the rapid appearance of widespread horizons associated with the Calf Creek and early Toyah periods is ostensibly linked to the sharing of weapons and processing-related technologies involved with logistically organized bison hunting at these times. Projectile point styles associated with these intervals are among the most widespread post-Paleoindian styles in Texas (cf. Prewitt 1995), and may reflect the distances traveled by bison hunters and the kinds of social encounters that occurred as part of these forays.* (Lohse et al. 2015)

What seems to be emerging from the work of Collins, Lohse, and others are the linked ideas that (1) climate fluctuations drive bison abundance; (2) periodic increases in bison abundance drive periodic changes in projectile point styles, as new generations of Native Americans take up the bison hunt; and (3) distributions of point styles across the Texas plains broadly reflect the distances travelled by hunter groups to find their prey; the points were dropped at kill sites or at other times in the process of hunting herds of bison. With regard to Central Texas, the origin of these hunting parties—or at least their lithic workshops where points were made—is typically interpreted to be the Balcones Escarpment and its associated canyons, which constitute the topographic interface between the relatively high Edwards Plateau of Central Texas and the lower Texas Plains to the east (Figure 7.2). The escarpment occurs more or less along a line stretching from southwest of San Antonio to New Braunfels and San Marcos, to Austin to near Georgetown, and farther to the north.

The Gault site is a northern outpost of the topographic escarpment, and has been a site for manufacturing tools and points since Upper Paleolithic time (Williams et al. 2018). As Collins and others (2011) put it, "Here canyons are carved by springs and streams into the Edwards Plateau, perpendicular to the Balcones Escarpment, thereby making geology, soils, climate, and hydrology the underlying factors contributing to the region's uniqueness and economic viability. . . . Gault, like many other archeological sites along spring-fed streams in the Balcones Canyonlands, has been an attractive place for human habitation from the Late Pleistocene to the present."

When drought hit the Texas Plains, lack of water was a real problem for hunter-gatherers, but the springs along the escarpment allow ready access to water in such times, not only for humans but for an entire ecosystem. In addition, humans benefitted from the presence of large amounts of tool-grade Edwards chert that are found in outcrops of the Edwards Formation, a Cretaceous limestone that is exposed all along escarpment (Figure 7.2). Hunters made their tools there and used them—when long-term climate conditions were favorable—for bison hunting trips in the plains to the east.

With these concepts in mind, maps have been made of the eastern half of Texas to show distributions of all the projectile point styles that were included in the Southeast Texas project database; some are Central Texas styles, but many others are not. These projectile point distribution maps are displayed in Atlas II. The base maps for these point style distributions include depictions of the large Central Texas and eastern Texas forested regions (Frames 1 and 2) as well as the lifeway zones within the Southeast Texas project area (Frame 2). The statewide projectile point distribution maps of Prewitt (1995) were used as a baseline, updated and extended with points data from Story (1990), Bousman and others (2004), and the Southeast Texas project database. Distributions are plotted at the county level (e.g., Frame 12), although individual point locations are also shown from Bousman where available (Paleoindian periods in Frames 4–8). Points data from the Southeast Texas project area and its database are plotted as individual archeological site locations superimposed on the three abovementioned lifeway zones.

The specific county locations of point style distributions, along with the even more specific site locations of point styles within the Southeast Texas area, allow a view of point styles that is geographically focused. A still higher level view of selected point styles is given at a continent-wide scale (Frame 3 is one example) in order to show the regional extent of some styles that occur significantly outside the state of Texas; these regional maps were compiled from a variety of sources including Anderson and others (2011), Jennings (2008), Jodry and Owsley (2014), Larsen (n.d.), Collins and others (2011).

These distribution data from Southeast Texas points, extended outward to adjacent zones, define four geographically constrained regions that each overlap the Southeast Texas project area:

(1) A Paleoindian Period group of *Great Plains Tradition* point styles used by relatively mobile hunters.

(2) An Early Archaic through early Historic Period *Central Texas Balcones Tradition* of hunters who were based in the spring-fed canyons of the Balcones Escarp-

ment but who hunted bison throughout the Texas plains. In each of the distribution maps of Atlas II, the outcrop area of the Edwards Formation along the Balcones Escarpment—source of the abundant tool-grade chert typically used in points of the Central Texas Balcones Tradition (CTBT)—is highlighted in purple for reference (e.g., Frame 12).

(3) A Late Paleoindian through early Historic Period *Trinity-Sabine Tradition* of hunter-gatherers who lived along forested, food-rich East Texas rivers and coastal areas but who periodically hunted bison and deer in the Texas plains.

(4) An Archaic through early Historic Period *Central Coast-South Texas Tradition* of hunter-gatherers who fished in the resource-rich brackish water coastal bays but who periodically hunted in the Texas plains.

There are two other groupings of point styles discussed that do not fit neatly into these four categories. First, there are two *Arrow Points with Expansive Distributions* that defy easy characterization and seem to have been influenced by Late Prehistoric Period regional trading and exchange of the type noted in ethnohistoric accounts. Second, there is a small group of points that seem to be the victim of problematic overlaps in shape-similar projectile types, and thus are not thought suitable for plotting the activity of various traditions versus time on the paleogeographic maps in Chapter 10.

In Figure 7.3, point styles and their approximate temporal ranges are shown within the same chronology that was displayed in Chapter 5, but is here subdivided into the four points traditions and accompanied by modeled Holocene rainfall data for Texas (climate data from Wong and others 2015). With two exceptions, these point styles include only types found in the Southeast Texas project area; no attempt at encyclopedic coverage of all Texas points was made. The points, grouped into traditions, show each of the traditions that were active within the project area. The term tradition is used here not in an ethnological or a strictly cultural sense but in the usage of Peregrine and Ember (2002: 2), who define tradition as:

> *a group of populations sharing similar subsistence practices, technology, and forms of sociopolitical organization, which are spatially contiguous over a relatively large area and which endure temporally for a relatively long period.*

Archeological traditions are not equivalent to cultures in an ethnological sense (and in like manner, they are also not equivalent to material cultures), because in addition to having defining sociocultural characteristics, traditions have both spatial and temporal dimensions. In any of the five traditions described here, tradition implies a human response to the ecology of a specific place that repeats itself over many generations. Each of these four traditions is taken up separately in the discussion that follows.

Before venturing into the analysis, it is worth drawing attention to the pertinent admonition of Dockall and Black (2006) about the use of point typology and, by inferred extension, the use of distribution maps for grouping points into—as in this report—"traditions":

> *Artifact typology, of course, is an ongoing process. Types are not "once and forever" categorizations, but simply best-guess descriptive groupings based on available*

Figure 7.3. A revised lithic chronol-ogy for Southeast Texas, sorted by lithic traditions (see Atlas II). Point time range estimates use OSL dates of Paleoindian point types from the Gault and Friedkin sites as well as various lithic chronologies (mostly calibrated with radiocar-bon dating) from Central Texas, Southeast Texas, and the Lower Mississippi Valley. Data sources:

1. Williams and others (2018)
2. Waters and others (2018) and Turner and others (2011)
3. Jennings (2008)
4. Turner and others (2011)
5. Lohse and others (2014)
6. Collins (2004)
7. Prewitt (2017)
8. Hall (1981)
9. Taylor and others (1995)
10. Perttula (2013)
11. Carpenter and Paquin (2010)
12. Patterson (1988, 1996)
13. Ensor and Carlson (1991)
14. Hays and Weinstein (2010)
15. McGimsey (2010)
16. Lehman (1982)
17. Crook (2020)
18. Patterson (1998)
19. Ford and Webb (1956)
20. Connaway (1977)
21. Dockall and Black (2006)
22. Quigg et al. (2000).

All temporal ranges of point styles should be regarded as approximations.

Climate trends (background color shading) are generalized from modeled annual rainfall variance data for Texas from Wong and others (2015). For explanation of climate data, see Chapter 3. Late stage Louisiana Archeological Periods are shown for reference alongside Southeast Texas Archeological Periods (left column): M, Mississippian Period; W, Woodland Period; P, Poverty Point phase of the Late Archaic Period.

*data and that are subject to revision and reappraisal. . . . Typology is not an end unto itself, but simply an analytical tool that is used to help address research questions and allow effective communication.*

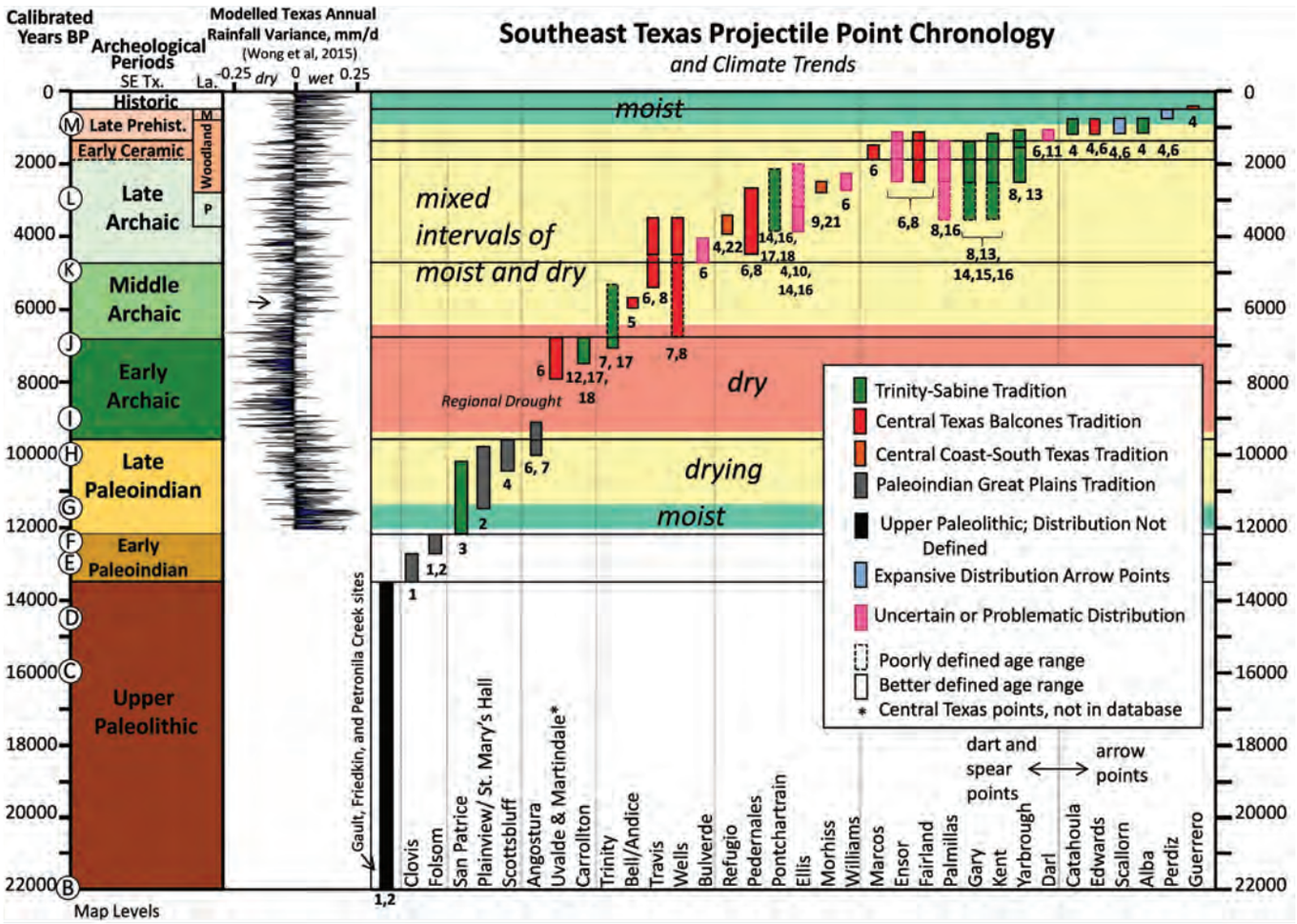
In that light, the regional groupings that follow are a "best-guess" interpretation from a Southeast Texas perspective, building upon the careful work of generations of field archeologists.

## Paleoindian Great Plains Tradition

Because archeological sites of the Upper Paleolithic Period are so sparse (in all of Texas there are only two of these sites firmly documented), the discussion here begins with the Early and Late Paleoindian Periods (Atlas II, Frames 3–8). The distributions of most Early and Late Paleoindian Period points are fundamentally different from all those that follow, primarily in the sheer size of their areal distribution (Clovis, Folsom, Plainview, Scottsbluff, and Angostura; Atlas II, Frame 3).

The general setting for Paleoindian hunting on the Great Plains was summarized by Frison (1998):

*From around 11,200 to 8,000 years ago [13,500 to about 9200 cal BP], the Great Plains of North America were populated by small Paleoindian hunting groups with well developed weaponry and the expertise to successfully hunt large mammals, especially mammoths and bison. Mammoths became extinct on the Plains by 11,000 years ago [ca. 12,900 cal BP], and, although paleoecological*



*conditions were worsening, their demise may have been hastened by human predation. After this, the main target of the Plains Paleoindian hunters consisted of subspecies of bison, Bison antiquus and Bison occidentalis. As bison populations gradually diminished, apparently because of worsening ecological conditions, by around 8,000 years ago, human subsistence was forced into a greater dependence on small animal and plant foods.*

**Clovis.** The Clovis point, the earliest of the group, is easily the most widespread and is found throughout North America, excepting the northeast region that was covered by the Laurentide ice sheet at that time. Early Native Americans carrying Clovis points were generalists, hunting in most of the ecosystems that North America had to offer: plains, mountains, eastern woodlands, deserts. They were also generalists in their diet and consumed considerable amounts of small mammals and reptiles in addition to big game (Collins 2007).

The widespread distribution of the Clovis point in the eastern half of Texas (Frame 4) mirrors that of its continent-wide distribution. The points are found not only in Central Texas and the adjacent Texas plains, but deep in the East Texas forest as well, which is consistent with the more generalist aspect of Clovis lifestyle already mentioned. Within Southeast Texas, most Clovis sites are in the Katy Prairie area, associated with long-occupation prairie hunting sites. The distribution of this style in the now submerged continental shelf, exposed during Clovis time, is unknown. There is a slight focus of Clovis points along the Balcones Escarpment, where the Balcones ecotone provided sustenance and the Edwards Formation provided abundant high-quality chert for points and tools. There, relatively large sites like Gault (Bell County) and Pavo Real (Bexar County) are rich and complex sites, suggesting that "an adaptation to relatively dry conditions based on generalized foraging in the better-watered zone along the Balcones ecotone, combines with large game hunting on the plains, probably by specialized hunting parties" (Collins et al. 2011).

Those hunting parties could be long-distance expeditions. At the McFaddin Beach site in Jefferson County (41JF50; the southeasternmost point location in Frame 4), a variety of Paleoindian points have been found washed up on the beach from an eroding offshore site. An analysis of lithic source material for the Paleoindian component, which includes a large number of Clovis points as well as Plainview, Scottsbluff, and Angostura points, showed that although the Edwards chert was the most frequently observed source material, other sources were from sites all around the Great Plains, including chert from the Knife River Flint of North Dakota, Weeping Water Creek in Nebraska, Spanish Diggings and Minnelusa in Wyoming, and Chuska in New Mexico (Stright et al. 1999).

## Communal hunting of bison on the Great Plains

The succeeding Folsom, Plainview, Scottsbluff, and Angostura point styles, unlike Clovis, are not continent-wide in their distribution, and each type occurs specifically within the area of the Great Plains, underscoring the inferred dominant use of these points in hunting bison there (Frame 3). The Southeast Texas coast is the only place where these latter four Great Plains point styles reach the present day

coast, and this would have been the same situation in Paleoindian time, except that the coast then was perhaps 100 miles farther to the southeast, beneath the modern Texas shelf.

As mentioned earlier, a dramatic change took place on the northern and southern Great Plains at the end of the Pleistocene. Mammoths, mastodons, and other large animals became extinct over a narrow time interval; some have thought this the result of human predation by Clovis-era hunters (e.g., the "overkill" hypothesis of Martin 1967, 2005). Others regard the extinction as a result of a changing climate, or of both causes (Kornfeld et al. 2010). Regardless of the cause, these extinctions opened up new plains habitat for bison (Kornfeld et al. 2010; Meltzer 2006, 2009). The bison of the Late Pleistocene era was *Bison antiquus*, a two-meter-high behemoth weighing over a ton. Studies of Folsom era and younger bison kills on the Great Plains show that the change from Clovis era big game hunting to Folsom bison hunting occurred at the beginning of the Younger Dryas climate event, a period of pronounced global cooling that began at 12,900 calibrated years BP and ended with renewed warming conditions at 11,500 BP. Extinction of mammoths is typically placed at nearly the same time, about 12,600 BP.

At this time of transition, Native Americans developed organized, communal bison hunting techniques and employed them across the Great Plains. Three main attributes were necessary for these communal hunting techniques to flourish (Carlson and Bement 2018):

1. Presence of bison in large herds. The use of large groups of hunters demanded the large rewards provided by herds of animals—primarily bison but, in the Katy and San Bernard prairies, also deer.

2. A favorable topographic setting. Details of topography allowed for migrating animals to be trapped. Some traps were natural corral-like features, such as steep-walled arroyos and stream gullies into which bison were led. Bison jumps occurred where bison could be forced to leap over a cliff to death or confusion or injury. Still others were forested impoundments— room-like clearings in riparian forests where bison could be led, focused, and surrounded for slaughter. To these could be added man-made features to aid natural topography, such as stone and brush drive lines and corrals.

3. Hunters in sufficient numbers to utilize communal hunting techniques, and sufficiently knowledgeable about critical elements of bison behavior. Bison tend to move together in herds, preferring open grassland over wooded areas. After the summer rutting season, males move away from the herd, and cow-calf herds can more easily be driven. At this time, large numbers of people are needed both for a successful drive and to process the meat in a time-effective manner before it spoils.

By late Clovis through Folsom time, bison hunting in the Great Plains was a often a communal endeavor, as deduced from studies of a large number of kill sites (Kornfeld et al. 2010; Carlson 2015). Animals were run into arroyo traps, killed, and butchered; hunters then processed the large amount of food and hides for win-

ter use. Jake Bluff, in western Oklahoma in the southern Great Plains, is the oldest bison mass kill site in North America, dated at 12,838 BP. Clovis tools were used in this arroyo trap, where a group of 22 bison were driven along the ditch-like arroyo until it ended in a dead end, where the animals were slaughtered. In a relatively small surrounding area named the Beaver Ridge Complex are several other arroyo kill sites that contain younger Folsom tools and document an 800-year-long period of activity for those local topographic features (Bement and Carter 2010; Bement et al. 2012).

**Folsom.** The Folsom point style was adapted to bison subsistence hunting across the Great Plains (Meltzer 2006), and its broad regional distribution in plains areas (Frame 5) is consistent with this interpretation. In eastern Texas the points are found predominantly in plains (prairie and savannah) settings, and not, for example, along the Trinity or Sabine rivers deep within the East Texas forest. The drier conditions brought on by the Younger Dryas climatic event at about 12,900 BP seem to have resulted in human population decline during Folsom use, an interpretation based upon lesser numbers of Folsom archeological sites relative to those of Clovis (Anderson et al. 2011). That general Great Plains–wide relationship is consistent with sites in the Southeast Texas project area, where there are significantly fewer Folsom sites (5) than Clovis sites (11), although the sample size is small. In Southeast Texas these rare points have been found at prairie sites in the San Bernard and Katy prairies as well as at two coastal sites near Clear Creek and McFaddin Beach, both of which were located well inland during Folsom time and were likely also prairie sites (see discussion, Chapter 10).

**Plainview.** Plainview points are unfluted, lanceolate-shaped points that are found broadly in Texas (Prewitt 1995). Their length seems well suited to the hunting of bison, which apparently was their main purpose in most of Texas. Plainview points are found at kill and butchering sites in the southern Great Plains, including New Mexico, Nebraska, Oklahoma, and Texas (Gunnerson 1987:18–21). The distribution of Plainview points in Texas shows a heightened focus in the Balcones Escarpment, and they are found all along the Colorado River east of the Balcones, in a line ending at the coastal prairie hunting areas of the Katy and San Bernard prairies, where these points—typically made of Edwards chart —are common (Frame 6). Johnson (1989) interpreted the finding of Late Paleoindian points in prairie areas of southeastern and eastern Texas as evidence of plains "interlopers" (mobile hunters) roaming in the eastern part of the state. Plainview points are not commonly found in the East Texas forest itself, consistent with the fact that most bison were plains animals. It is unknown how these points were used along the Texas coast, because the coastline was much farther out to the southeast at this time (the McFaddin Beach site in Jefferson County is the farthest southeastern observed site, but as mentioned, it was in an upland setting at the time). The strong relationship of Plainview points with southern Great Plains bison hunting suggests that the Katy and San Bernard prairies constitute a southeastern edge of that hunting habitat (Frame 3). San Bernard Prairie site faunal data, including the occurrence of bison bone, support this inference and are discussed in Chapter 8.

**Scottsbluff and Angostura.** The Scottsbluff is a minor point style in Central Texas as well as in Southeast Texas, where only a few locations have been noted

(Katy Prairie, San Bernard Prairie, and McFaddin Beach; Frame 7). Collins and others (2011) note that climatic conditions were getting drier during this time, and that it was a period of relative bison absence. They note the same adverse climatic conditions in Texas were in play at the time of the Angostura point (Frame 8), but Angostura's distribution is nearly as robust as that of the Plainview point. In Southeast Texas Angostura points are fairly common in Katy and San Bernard prairie sites. The Angostura point, like the Plainview, is a style with a broad distribution across the Great Plains, but in Texas appears to reflect a mobile hunter base radiating out from the Balcones escarpment into the surrounding plains and prairies.

In summary, the Paleoindian Great Plains Tradition point styles are distributed very widely across the Great Plains, where Paleoindian hunters pursued bison across the plains of the middle of the American continent. The Katy and San Bernard prairies as well a few adjacent prairie areas in Southeast Texas constitute the southeasternmost outposts of the Great Plains ecosystem.

These bison-hunting cultures were not the only occupants of Southeast Texas and adjoining regions in Late Paleoindian time. In particular, another culture specialized in living along the large Trinity-San Jacinto and Sabine-Neches rivers in the East Texas forest, as well as hunting in the adjacent plains of northeast Texas and Oklahoma plus the Katy and San Bernard prairies to the southwest. This Late Paleoindian Period San Patrice culture (Frames 3 and 21), described later as part of the Trinity-Sabine Tradition, represents the first appearance of a more specialized and localized type of regional existence—attuned to much less expansive point distributions—that was to dominate the Southeast Texas Archaic. In other parts of the Great Plains outside of Texas, similar regional cultures with other localized point styles developed. These are not shown in Frame 3, which focuses only on points with distributions that reach into Southeast Texas.

## The beginning of the Archaic, with changes in lifeways

In the last decade, understanding of paleoclimate conditions in Texas has grown considerably. It is generally understood that cooler, wetter conditions in the Late Pleistocene gave way to warmer, drier conditions in the Holocene in the southwestern United States (Asmeron et al. 2010; Wagner et al. 2010; Feng et al. 2014). Temperature and precipitation were modeled for the Texas region by Wong and others (2015) using climate "proxy" measurements taken at various places in Texas and Oklahoma and "stacking" them in a single climate model (see Figure 3.15). Proxies are naturally occurring, measurable phenomenon that track either temperature or precipitation or both. For example, at well-studied Hall's Cave in Central Texas, a thick, well-stratified sequence of late Pleistocene and Holocene deposits have been radiocarbon dated at numerous horizons as well as studied extensively for faunal and floral remains (Toomey 1993). Of most importance for present purposes are two types of shrew: *Cryptosis* (least shrew), which requires a moist environment, and *Notiosorex* (desert shrew), which requires an arid environment. By measuring their relative abundance versus time, a relative precipitation record can be produced that is one of the most environmentally sensitive and well dated such sequences in North America (Collins 2004). Wong and others (2015) measured trace element concen-

trations in the growth rings of a stalagmite from Natural Bridge Caverns that are well known to relate to moisture content, and measured how they varied through middle and late Holocene time. Other such climate indicators include fluvial sediment records from Texas and Oklahoma, carbon isotope data from soil carbonates, and timing of Eolian deposits. "Stacking" these various data sets together by Wong and others produced the relative precipitation record shown in Figure 7.3, which highlights relatively wet versus relatively dry times in the archeological record.

The decline in bison abundance noted by Collins during the times of Scottsbluff and Angostura points became more dire during the Early Archaic, with dramatic decreases in bison population observed from archeological sites in the southern Great Plains (Dillehay 1974). This observed decline is mirrored in the modeled precipitation data, which shows a pronounced dry period during almost all of the Early Archaic (Figure 7.3). This dry period may be the reason for the relative dearth of point styles in Early Archaic of Southeast Texas seen on that figure. Collins notes that in Central Texas, an Early Archaic point style called Hoxie is mostly found only in the spring-fed canyons of the Balcones Escarpment; there must have been little for hunters to do in the sun-baked plains of the era. The Hoxie point is not found in Southeast Texas.

In general, the long Archaic period that ensued was a time when human populations became somewhat more sedentary, and hunting of much more diverse prey than just bison was practiced (Collins 2007). In contrast to the Great Basin–scale distributions of Paleoindian points, all succeeding point styles that are found in Southeast Texas have much smaller distributions (compare the regional map of the Paleoindian Great Plains Tradition (Frame 3), with those of the aforementioned Central Texas Balcones Tradition (Frame 9); Trinity-Sabine Tradition (Frame 20); and Central Coast-South Texas Tradition (Frame 31). The sharp difference in scale of point style distributions and the attendant abruptly different subregional specialization that began in the Early Archaic is striking. Each of these latter three traditions has a unique ecological *refugium* at its heart. As was mentioned above, refugia (plural) are defined by population biologists as areas where special environmental circumstances allow populations of organisms to survive through a period of unfavorable conditions. In Texas, a particularly unfavorable condition is that of periodic regional drought. Refugia of more limited geographic extent allowed each of these traditions to survive during such hard times. Points of all three of these traditions are found in Southeast Texas, some carried over a hundred miles into the area to be dropped at—in many cases—the same archeological sites used by hunters of the other traditions, the apparent product of periodic visits by different groups from their respective refugia to geographically favored prairie hunting sites, a process to be repeated again and again over millennia.

## Central Texas Balcones Tradition

As mentioned, the Central Texas Balcones Tradition centers upon the spring-fed Balcones canyons, which provided not only a refugium with food and water, but also rich supplies of tool-grade Edwards chert. Points of this tradition are typically found in greatest abundance along the Balcones Escarpment but are also found at

prehistoric campsites radiating outward from the escarpment in all directions.

**Uvalde and Martindale.** The dry spell that typified the Early Archaic (Figure 7.3) was present during the time of use of Uvalde and Martindale points, dated at around 6,800 to 8,000 rcyBP by Collins and others (2011). The distribution maps of these two point styles included in Atlas II (Frames 10 and 11) show that neither distribution reaches deeply into the Texas plains, and neither reaches as far east as the San Bernard and Katy prairies of Southeast Texas. The implication, following Dillehay, Collins, and Wong and others, is that the Texas plains were still dry and bison were scarce.

**Bell and Andice.** Beginning at about 6400 BP, the long Texas drought began to lessen, and a time of mixed periods of moist or dry climate ensued, which lasted until fairly constant moist conditions began in the Late Prehistoric (Figure 7.3). Probably because of the amount of noise in the precipitation data, as well as uncertainty in the dating of many points, it is difficult to tie a particular point style to a particular moist period with any certainty. Exceptions are the closely related Bell and Andice points of the Middle Archaic. Their distribution (Frame 12) was dated from association with bison remains at Calf Creek and multiple other sites in the Oklahoma and Texas plains by Lohse and others (2015), yielding dates that were sharply focused between 5955 and 5815 BP. Mayewski and others (2004) note that this was a period of rapid climate change that favored the return of bison to the southern plains. The precipitation model of Wong and others (Figure 7.3) shows a remarkable and abrupt increase in precipitation at the same time (highlighted with an arrow on the precipitation chart). Lohse and others interpreted the related bison kill sites of that horizon as indicating

> *"Plains-like" cultural patterns that depended in part on environmental and climatic change and the subsequent exploitation of bison for subsistence . . . [Bell and Andice] projectile point styles . . . are among the most widespread post-Paleoindian styles in Texas . . . and reflect the distances travelled by bison hunters and the kinds of social encounters that occurred as part of these forays.* (Lohse et al. 2015)

The point style is unique (Figure 7.4), with long tabs on either side of the point that seem rather fragile. Such originality suggests a culture with a new take on point construction that somehow caught on. In Southeast Texas, the Bell type is found most commonly in the Katy and San Bernard prairies (Frame 12), in sites of favored hunting geography with very long occupation histories (Chapter 8).

**Travis and Wells.** The distribution pattern of two other, slightly younger Middle Archaic point styles, Travis (Frame 13) and Wells (Frame 14) both show the typical Central Texas Balcones Tradition (CTBT) focus on the Balcones heartland with forays out into the plains. Both styles extend prominently eastward from the Balcones in sites along the Colorado River, ultimately extending to the Katy and San Bernard prairies. Neither occurs much in inland parts of the deep East Texas forest and its Trinity and Sabine-Neches rivers, from which one might infer that bison were mostly absent there. As Figure 7.1 shows, the remains of very few bison have been found in the Southeast Texas forest.

**Pedernales.** The Pedernales point (Frame 15) is indicative of a moister (less

Figure 7.4. Representative projectile points from Southeast Texas. The Clovis and Scottsbluff points are heavily resharpened. The Clovis and Plainview photos are from Larry Golden, Houston Archeological Society. The Folsom point is from a display at the Houston Museum of Natural Science. All other photos are from the Andy Kyle Collection, courtesy of Wilson W. Crook III.

xeric) time in the early Late Archaic, when bison were abundant (Collins et al. 2011). It displays a classic Central Texas Balcones Tradition distribution, with a strong focus at the Balcones Escarpment and extensions heading northeast, east, and southeast, especially along the Colorado River, where the points are found in robust numbers as far east as the San Bernard and Katy prairies. One of the ten Pedernales points found at site 41WH2 along West Bernard Creek in the San Bernard Prairie is made of central Texas Edwards chert, but others appear to have been made from local Colorado River chert sources (Patterson and Hudgins 1980). Several of the sites in that prairie, including this one, show evidence of local manufacturing of points, suggesting that the sites were used for longer periods of time than quick overnight hunting stops. Other sites in this area show evidence of butchering and cooking (more on this later), suggesting that they were processing sites following a successful communal hunt.

**Marcos** points (Frame 16) are Late Archaic or Early Ceramic in age, when a time of mixed intervals of moist and dry periods continued in Texas. Marcos points show a Balcones-Central Texas focus, with forays eastward as far as the Katy and San Bernard prairies, and no evidence of use in the East Texas forest. Collins reports that the Marcos occurred during a mesic period and that its broad shape was well suited to hunting bison.

**Fairland** points (Frame 17) also have a focus in the Central Texas Balcones region, with extensions along the Colorado, Guadalupe, and Nueces rivers to the east and southeast. There are a number of these points in the San Bernard prairie sites, but none in the Katy prairie. As is the case with Marcos, none are reported in the East Texas forest along the East Texas rivers. The Fairland point was used in the violent death of a Native American in the Late Archaic Lower Brazos Culture, described in Chapter 11; the burial is at the Witte site (41AU36) near the Brazos river,

described by Hall (1981). Other Late Archaic points found in and around that site are from both the Trinity-Sabine and Central Coast-South Texas point traditions, and it is clear that multiple cultural groups were hunting in the same prairie areas, perhaps leading to conflict. Fairland is dated at between 1650 and 2450 rcyBP at Burial Group 2 at the Witte site (Hall 1981), similar to the time range estimated by Collins (2004) for that point in Central Texas.

**Edwards.** This arrow point style (Frame 18) is one of the earliest of arrow points, and its distribution is focused in Central Texas, with forays into the prairies and plains to the east and south (Turner et al. 2011). It reaches as far east as the San Bernard Prairie as well as one site in the Katy Prairie.

### Summary, Central Texas Balcones Tradition

The distribution patterns for the Central Texas Balcones Tradition are schematically summarized in a conceptual model, Frame 19. From a landscape view, the locations of combined archeological sites of Central and eastern Texas support the contention of Collins and others (2011) that a long-term refugium existed in the ecological niche that is the Balcones Canyonlands (Escarpment), where perennial water and food sources, plus readily available supplies of chert, sustained human cultures for millennia. Bison, the premier food source, were only periodically available on the adjacent Texas plains, but when they were, mobile hunting parties fashioned points and pursued them for relatively long distances. Those hunting expeditions often brought Central Texas hunters down the Colorado River into the San Bernard and Katy prairies of Southeast Texas. As we shall see, however, those Central Texas hunters were not the only ones hunting those two prairies.

## Trinity-Sabine Tradition

In the forest of eastern and southeastern Texas, within the drainage basins of the Trinity-San Jacinto and Sabine-Neches rivers, a very different but also long-lived tradition existed, here named for the two main river systems, the Trinity and its former tributary the San Jacinto River, as well as the Sabine River and its main former tributary, the Neches. The points of this tradition are clustered around those rivers in the "big river" lifeway zone (Frame 2)—but also typically range deep into Louisiana; points of this group are commonly found as far east as the mound settlements in the Lower Mississippi Valley, for example. Large rivers of the East Texas and adjoining Louisiana forests formed a refugium with ever-present fresh water, wood, and abundant floodplain food resources. In the Southeast Texas area, the tradition's core territory is along the Trinity-San Jacinto and Sabine-Neches rivers, but hunters ranged outward into the surrounding prairies to the north, west, and southwest, including the Katy and San Bernard prairies, producing a schematic total distribution as shown in Frame 20. In essence, the tradition is an East and Southeast Texas counterpart to the Central Texas Balcones Tradition, and as the point distributions show, people from both traditions hunted in the intervening prairies.

**San Patrice.** The oldest point style that displays the distribution of this tradition is that of the Late Paleoindian San Patrice (Frame 21). Its home territory is East and Southeast Texas, along with adjacent parts of the Red River drainage in

Arkansas and Louisiana (Jennings 2008; regional extent shown on Frame 4). Most of that area is woodland, but San Patrice points are also found in plains settings in northeast Texas, as the map shows. The San Patrice culture did not extend deeply into central and south Texas. Within and near the Southeast Texas project area, it is prominently found along the Trinity, Neches and Sabine rivers, and—interleaved with Central Texas Plainview points—at sites in the Katy and San Bernard prairies.

The San Patrice point is decidedly stubbier than the coeval Plainview point of the Central Texas Balcones Tradition, and usually has a prominent "fishtail" base shaped by notches (Figure 7.4). The stubby shape of San Patrice points may reflect the use of small river cobbles as source material. San Patrice points are typically made of local East Texas materials harvested from chert in the Trinity, Sabine and Red rivers, from petrified palm wood from the Catahoula Formation (see Chapter 9), and red jasper from cobbles in the Red River drainage (Saunders and Allen 1997). Crook and others (2017) noted that chert Clovis, Dalton, and Angostura points in the Kyle collection all fluoresce under UV light, interpreted as an indicator of source from the Edwards Formation of central Texas, whereas most of some 40 San Patrice points did not fluoresce, indicating a probable local East Texas chert source. Jennings (2008; also see Perttula 2013) noted that only 6% of San Patrice points found in woodland settings were of exotic rock types, whereas 21% of those points found in plains settings were. A possible interpretation is that San Patrice woodland hunters venturing out into the plains on seasonal hunts replenished their point supply as necessary, much as did their central Texas contemporaries as discussed above.

**Carrollton and Trinity.** The principal point styles of Middle Archaic age in the Southeast Texas area that are noted by Patterson (1996) are Carrollton and Trinity (Frames 22 and 23). Relative dating suggested a placement in the Middle Archaic (e.g., the Owens site, 41HR315, on the Katy Prairie [Patterson 1980]), but a Carrollton radiocarbon date of 5945 BP (late Early Archaic) was observed by Crook (1959) in the upper Trinity watershed. Crook (2020) has reassessed dates of the Carrollton Phase along the north Trinity River and places Carrollton points there at no younger than 6000 BP. Crook and Harris (1952) observed that Carrollton and Trinity points are closely associated there, but that Trinity points clearly range younger into overlying Middle Archaic units (Crook 2020, personal communication). Finally, Patterson (1998) obtained a radiocarbon date at 6490 BP for material associated with a Carrollton point at 41FB37; Crook (2020) considers the point's age range to extend even farther back. Between this point style and the next oldest Trinity-Sabine Tradition point (San Patrice) is a large time gap that spans most of Early Archaic time. Neither of two Early Archaic point styles of the Central Texas Balcones Tradition, Martindale and Uvalde, reaches into the San Bernard and Katy prairies, reinforcing the finding of Dillehay (1974) that the Early Archaic Period appears to have been nearly devoid of bison during a time of relative drought (see chronology, Figure 7.3). It also supports the hypothesis of Collins and others (2011) that point styles evolve as the need for bison hunting presents itself; a long dry climatic period with no bison should present scarce new points in the prairie and plains areas. Presumably, either San Patrice or Carrollton and Trinity points might have filled in the time gap in their forested riverine refugia, where it would be presumed that

life continued in spite of widespread drought—but as already mentioned, absolute dating in the East Texas forest is scarce.

Carrollton points are typically small- to medium-sized chert points with a distinctive "Christmas tree" shape, whereas Trinity points, also typically made from chert, have much weaker shoulders. The chert is typically from local Southeast Texas river cobble sources (Crook et al. 2017). Carrollton and Trinity points were first described in the upper Trinity River watershed of northeast and north-central Texas by Crook and Harris (1952), but they are found in the upper Sabine-Neches and Calcasieu drainage basins as well (Anderson and Smith 2003). In Southeast Texas, Carrollton and Trinity points are found in the lower parts of the Trinity, San Jacinto and Sabine-Neches rivers (Crook 2018), but like other Trinity-Sabine Tradition points, they are also found in hunting sites of the Katy and San Bernard prairies, along parts of the Brazos River, and in the plains of northeast Texas. In Louisiana, Carrollton and Trinity points are present in numbers at the Avery Island site near Vermilion Bay (Gagliano 1967). Neither form is found along most of the Balcones Escarpment, emphasizing the separation of the Central Texas Balcones and Trinity-Sabine traditions. The overall distribution is evocative of a riverine, eastern Texas and western Louisiana woodland culture or cultures whose people also hunted in the adjacent plains and prairies.

### Late Archaic to Late Prehistoric Period Woodland cultures

The remaining points in this Trinity-Sabine grouping are also found in the various sites of mound-building cultures of the Lower Mississippi Valley. In that area, a cultural development stage that comprises the interlude between Archaic hunter-gatherers and Mississippian Period farmers has been termed the "Woodland Period." In the Lower Mississippi Valley (LMV), its beginning is pegged at around 800 BC, and it ended with the application of widespread agriculture at about AD 1200 (Rees 2010a; see time chart of Lower Mississippi Valley periods and cultural stages, Figure 7.5). It was a time of large ceremonial mounds, indicating a more complex social organization, although mound-building started much earlier in the LMV. There were sporadic Middle Archaic mounds, notably at Watson's Brake, Louisiana (Saunders 2010), but mound building cultures reappeared in a big way during the Poverty Point culture, named for a Lower Mississippi Valley site in northeastern-most Louisiana, beginning about 1700 BC (Figure 7.5, thrid column; Gibson 2010). A noted development of Poverty Point time was a large regional exchange in lithic and other goods that ranged westward into the Ouachita Mountains of southwest Arkansas, as well as to other points as far north as Lake Superior, where copper was mined (Gibson 2010). During this time technological innovations were introduced, prominently including ceramics of the Tchefuncte culture (Early Woodland period) that migrated westward to Southeast Texas by about AD 100 (Aten 1983).

Southeast Texas was a fringe area to the west of all this cultural and technological activity but was profoundly impacted by it. The effects of that activity and the implications for movement of people, technology and ideas into the Southeast Texas area from the LMV are worthy of a much larger discussion, presented in Chapter 11. For now, we confine the discussion to projectile point styles. The Trinity-Sa-

bine Tradition, despite the name given here to it, extends into and includes the mound cultures of the Lower Mississippi Valley, and those LMV sites were very likely the home of larger and more socially organized societies than contemporaneous, generally moundless hunter-gatherer groups of Southeast Texas.

**Pontchartrain.** The Pontchartrain is a minor point in Southeast Texas (Patterson 1996), with an age range equivalent to that of the Pedernales point, and an unusual shape. Its gross distribution (Frame 24) is not dissimilar from that of the younger Gary point, but with much less frequency in the Kary and San Bernard prairies as well as the Trinity River. However, it is a major type in Louisiana and the LMV. It is the third most common point at Poverty Point after Gary and Ellis (Ford and Webb 1956), and is found as far east as the Tchefuncte-culture Big Oak and Little Oak Islands in east New Orleans (Hays and Weinstein 2010). They are the most numerous point type found at Jaketown, a Poverty Point culture site in western Mississippi, just northeast of the Poverty Point site in northeastern Louisiana, where they were made from local gravels (Lehmann 1982). They are also present farther north at the Denton site in Northwest Mississippi (Connaway 1977). The prevalence of the points in the LMV versus their scant appearance in East Texas would support an LMV origin of the type.

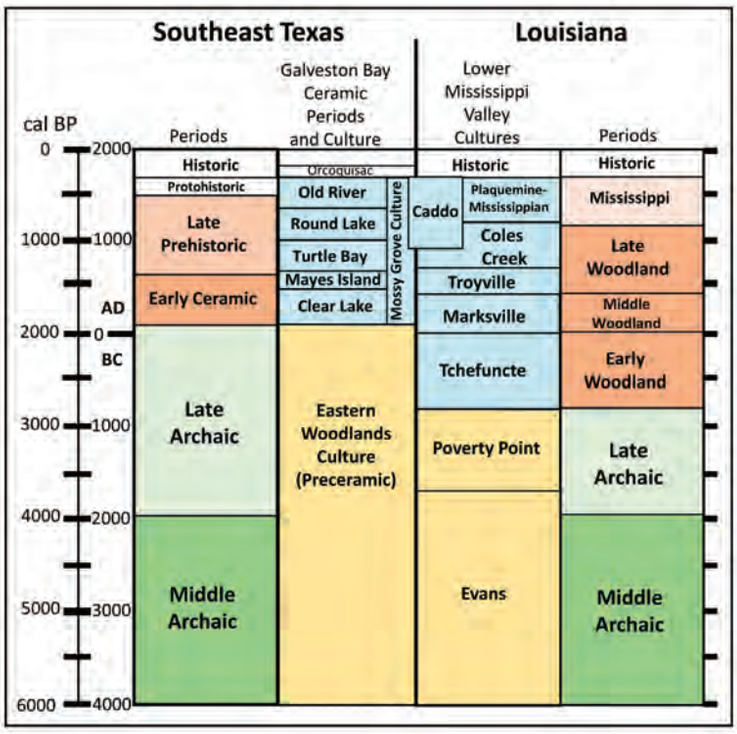



Figure 7.5. Post-6000 BP chronology of Southeast Texas and Louisiana. The timing of Galveston Bay ceramic periods is from Aten (1983) and Story (1990). Louisiana periods and cultures are from Rees (2010a). In the central two columns tan shading rep-resents pre-ceramic cultures, and light blue is for cultures with ceramics.

**Gary and Kent.** Gary and Kent points represent by far the most prominent projectile point styles of the Late Archaic and Early Ceramic Periods found in inland parts of Southeast Texas (Patterson 1996). As can be seen in Frames 25 and 26, both types are prominently found along the Trinity, San Jacinto, and Neches rivers in Southeast Texas (bearing in mind the inherent sampling bias in the database that undersamples the Neches and Sabine rivers). Gary points are found in large numbers at sites along the upper parts of the Trinity, Neches, and Sabine river basins (Frame 25). Gary points are the most frequent point style within the Kyle collection, most of which came from locations at or near the Trinity River. Crook and others (2017) report that most of these points in that collection appear to be locally made of heat-treated quartzite. Gary and Kent points are also prominently found in nearly all excavated sites in the Katy and San Bernard prairies, evidence for extensive use in prairie hunting. Gary points at the Alabonson Road site in Harris County (Katy Prairie) were dated at 1150 to 1550 rcyBP (AD 400 to 800; Ensor and Carlson 1991), and were found in Zone 4 at the Witte site (41AU36) at the edge of San Bernard Prairie, dated at 1000 to 1400 rcyBP (550–950 AD; Hall 1981).

Gary points are the type most frequently found at the Poverty Point site in the Lower Mississippi Valley (Kent points are also present), and are also the most frequent style in general at sites in northwestern and central Louisiana (Ford and Webb 1956; Gibson 2010). Gary and Kent points are prominently found at Jake-

town. Jaketown occupation is dated at from 1080 to 200 BC (Lehmann 1982). Gary and Kent points are a frequent part of the collection from the Denton site along the Yazoo River in northwest Mississippi, where they are typically crafted from local river gravels (Connaway 1977). These types are well known at younger Early and Middle Woodland sites in Louisiana (Tchefuncte and Marksville cultures, 800 BC to 900 AD; Hays and Weinstein 2010; McGimsey 2010). Gary points are present in central Arkansas, where they may range as young as 400 to 1000 AD (Late Woodland Period), and are found in northeast Oklahoma and eastern Kansas (Nassaney and Pyle 1999).

The resulting regional distributions of Gary and, to a lesser extent, Kent points (Frame 26), are temporally and geographically expansive and cover the Lower Mississippi Valley and the Ouachita Mountains as well as eastern Texas. Gary and Kent points were in use during the Late Archaic (Poverty Point culture) as well as throughout the Woodland period, during the peak period of Woodland culture mound building in the Mississippi Valley. Their temporal expansiveness suggests that point styles in the more humid East Texas-Louisiana region might be less constrained by short term climate trends than those of the Central Texas Balcones tradition.

**Yarbrough.** The distribution of the Late Archaic to Late Prehistoric Yarbrough point (Frame 27) shows a strong focus along the Trinity and Sabine-Neches rivers, with outliers in the plains of northeast Texas as well as, prominently, the Katy and San Bernard prairies. Yarbrough points were found in Zone 3B at the Witte site (41AU36), a Late Archaic cemetery on the Brazos River, associated with Burial Group 2, dated between 1650 and 2450 rcyBP (Hall 1981). They were found there in association with Kent and Palmillas points. A similar age range is offered by Ensor and Carlson (1991) at the Alabonson Road site in the Katy Prairie.

Yarbrough points are found alongside Gary and Trinity points at the Poverty Point site in the LMV (Ford and Webb 1956). Patterson (1996) notes that Gary, Kent, and Yarbrough points are often found together in Southeast Texas as well (all three especially are grouped in riverine sites along the Trinity River, as shown in Frames 25–27); Patterson considered that these might simply be manufacturing variants of each other. Yarbrough points reach Avery Island in southwestern Louisiana as a minor type there (Gagliano 1967).

**Catahoula.** The Late Prehistoric Catahoula point (Frame 28) is an example of the new arrow point technology that swept through all of Texas and neighboring areas in Late Prehistoric time. In Southeast Texas the points are tightly clustered along the Trinity River, home during the slightly later early Historic Period to the Akokisa and Bidai bands of the Atakapa. Along the Neches River these points are also present, but in smaller numbers—perhaps the result of sampling bias resulting from the greater distance to the area for Houston-based archeologists, discussed in Chapter 5.

Another focus area of the Catahoula point is in the hunting areas of the Katy Prairie (Frame 28). Ethnohistoric accounts discussed in Chapter 8 show that Akokisa hunters from the San Jacinto River estuary made seasonal trips during the late fall or early winter into the Katy Prairie to hunt bison, and that Bidai hunters made extended hunting trips to the Grimes Prairie (see Frame 2 for prairie locations); these

early Historic Period occurrences are only very slightly younger than the Catahoula arrow points. Spanish observers in the mid-eighteenth century visited the winter villages of riverine Akokisa and Bidai groups, in these two prairies. The points are also common on the far extensions and upland tributaries of the Trinity and Sabine, in northeast Texas, possibly campsites of prairie hunters using these points; Lohse and others (2015) note the Late Prehistoric as a period of bison abundance.

In Louisiana these points are associated with numerous Coles Creek and Plaquemine sites in the LMV, plus coeval Caddo area sites in northwest Louisiana. They are found as far east as Tangipahoa Parish, near New Orleans (Baker and Webb 1977). Characteristically, Catahoula points have distinctive, squared-off shoulders to their barbs (see drawing, Frame 28). They are typically made of local materials from East and Southeast Texas, including chert and quartzite cobbles from the Trinity and Sabine rivers, as well as silicified wood from outcrops of Tertiary formations of the region, including the Catahoula Formation, where fossil palmwood is abundant. Catahoula points in the Kyle collection, mostly from sites along the Trinity River, include such local materials (Crook et al. 2017).

**Alba.** The technology revolution caused by the use of bows and arrows is also represented in the Trinity-Sabine Tradition by the Alba arrow point (Frame 29). This style is widespread across East and Southeast Texas, including the Trinity and Neches river lifeway zones in the East and Southeast Texas forest, along the coast lifeway zone at Galveston Bay, and in the Katy and San Bernard prairies to the southwest. Alba points are also found in northeast Texas, in the savannah and prairie areas along the upper Trinity and Sabine drainage basins. Alba points found along the Lower Trinity River are made of local pebble materials found in East Texas rivers, including chert, jasper, novaculite, quartzite, and silicified wood, and are typically heat-treated (Crook et al. 2017). Alba points are the most common arrow point at coastal Avery Island, Louisiana (Gagliano 1967). Anderson and Smith (2003) report that the point is common in the upper Calcasieu River drainage basin at Fort Polk, and that it is common in Caddoan and Coles Creek cultures in Louisiana and adjoining states (southeast Oklahoma and southwest Arkansas). Nassaney and Pyle (1999) report its occurrence in Coles Creek sites (ca. AD 700–1100) in central Arkansas.

Alba points in northeast Texas and adjacent states are linked with ancestral Caddo people, who migrated into northeast Texas as well as parts of northwest Louisiana and southeast Oklahoma at around AD 800 (Perttula 2020). These were agricultural people, in contrast to ancestral Atakapa. Alba points appear at the Old Timers Site in the upper Sabine River drainage basin in Smith County (Perttula 2018) at a horizon dated at ca. AD 1000–1300 (Early Caddo Period, similar in age to the LMV Mississippian; see Figure 7.5). At that site Alba points overlie Woodland era Gary and Kent dart points associated with the earlier Mossy Grove culture, which was indigenous to the region prior to the coming of the Caddo, who seem to have originated in the Red River Valley to the east (see discussion, Chapter 11). Perttula reports that the points are made of pebbles from local streams, and include red and brown chert as well as silicified wood. The Alba points are overlain at that site by Late Caddo Period Perdiz points.

Shafer (2006) has hypothesized that many Late Prehistoric sites in the northeast

Texas prairies—outside the area of classic Caddo Piney woods (East Texas Forest) sites such as the George Davis site (41CE19) of Cherokee County—were campsites of Caddoan hunters in the prairies ("Prairie Caddo"). Shafer's distinction was based on lithic and ceramic assemblages at these sites that were distinctly Caddoan and unlike those of Central Texas Toyah and Austin Phase hunters. He suggested a new point type (Bonham-Alba) based on a longer point than classic Alba, with a somewhat recurved blade, that he associated with these prairie sites. That type has not been observed in Southeast Texas, but neither was Southeast Texas a Caddo area. A possible Historic Period analog for Shafer's "Prairie Caddo" is provided by pioneer artist George Catlin's ca. 1847 painting of Caddo hunters, on horseback, pursuing bison in the Texas Cross Timbers region, far to the west of their known villages in East Texas and southeastern Oklahoma (Figure 7.6). It would appear that even the extensive use of agriculture by the Late Prehistoric and Modern Period Caddoan people—a large step forward from focusing only on hunting and gathering—was not something that would deter them from hunting bison when it was available.

### Summary, Trinity-Sabine Tradition

The distribution of these Late Paleoindian through the Late Prehistoric points is consistent with that of a riverine refugium along the Trinity and Sabine rivers and their major former tributaries, the San Jacinto and Neches – the "big river" lifeway zone. Projectile points of this tradition are also found at campsites in the surrounding plains of northeast Texas and in the Katy and San Bernard prairies to the southwest, where multiple ethnohistorical sources describe hunters of riverine and coastal people going to pursue bison. A proposed model for the Trinity-Sabine Tradition is shown in Frame 30, which depicts a riverine refugium with its residents taking extended hunting forays into adjacent areas. In effect, it is an eastern counterpart to that of the Central Texas Balcones Tradition; hunters from both traditions hunted the intervening savannahs and prairies for millennia.

Beyond East and Southeast Texas, many of the Trinity-Sabine Tradition point styles are strongly represented in adjacent Louisiana, southwestern Arkansas and

Figure 7.6. *Caddo Indians Chasing Buffalo, Cross Timbers, Texas.* Painting by George Catlin, ca. 1846–1848. The Caddo, like the western Atakapa, were known to venture out of their eastern Texas homeland to hunt bison on the Texas plains. They used Spanish horses by at least the early 1700s. Courtesy of the Smithsonian American Art Museum, gift of Mrs. Joseph Harrison Jr.

parts of the Lower Mississippi Valley, as mentioned earlier. The ecological region that includes the eastern Texas forest extends east to the Mississippi River, and north at least as far as central Arkansas in what is termed the "Pineywoods" (Figure 7.7). The broad distribution throughout the Pineywoods region of points like San Patrice in Late Paleoindian Period, or Kent and Gary in the Late Archaic and Early Ceramic periods, or Alba in the Late Prehistoric Period, is consistent with a series of cultures within this tradition inhabiting the same ecological niche over time.

In Late Archaic and later time (if not earlier), the Pineywoods and its Trinity-Sabine Tradition nurtured two separate cultural groups. In the north, spreading out from the Ouachita Mountains and the upper Red River was the Fourche Maline culture, which by the Late Prehistoric and Historic periods became the Caddo. In the south (Southeast Texas), by the Early Ceramic period the Mossy Grove culture later became the Atakapa. A finer resolution of these cultural developments is allowed by use of ceramic data as well as a trade in exotic exchange items; this topic as well as the interaction of Trinity-Sabine Tradition cultural groups with the Mississippi Valley and other parts of eastern North America is taken up in Chapter 11.

## Central Coast-South Texas Tradition

There is one other long-lasting tradition in the region, located on the central coast and extending at times as far south as northeastern Mexico (Atlas II, Frame 31). What is here termed the Central Coast-South Texas Tradition is seemingly not as old as the Central Texas Balcones and Trinity-Sabine traditions. There are no known Early Archaic examples of points of this tradition, for example, suggesting that the very dry conditions of the Early Archaic made life in South Texas difficult at best. The tradition has its refugium focus (at least, its Texas part) in the protected bays and associated small rivers of the central coast, where fresh river water was available year-round, along with rich supplies of brackish water fish and shellfish. Inland areas supplied deer, pecans, prickly pear tunas, aquatic roots, and other foods encountered by Cabeza de Vaca during his stay along this coast in 1528 (Chapter 4). Ricklis (1996) notes that the Archaic Period has not been expansively studied here, and its local manifestation is termed the "Aransas Focus" in order to distinguish it from a "Rockport Focus" that began with the local time of acquisition of ceramics, ca. AD 1000.

Ethnohistoric sources place the Karankawa cultural group here during the early Historic Period, and ceramics used by the historic Karankawa tie them to the prehistoric Rockport culture (Ricklis 1996). The Karankawa lived primarily off fish and shellfish, but Spanish observers also saw Karankawas at interior sites, where they took part in inland communal hunting of deer and bison. The Coco band of Karankawa lived in the coastal area between the Colorado and Brazos rivers, and the San Bernard prairie was an inland extension of their homeland in the early Historic Period. Bison were plentiful in the coastal prairie during La Salle's stay in the late eighteenth century, and Karankawa as well as Europeans regularly feasted on them (Chapter 4).

**Refugio.** The Refugio point, the oldest included in this tradition (Frame 32), is a minor type in the Southeast Texas project area, of Late Archaic to Early Ceramic

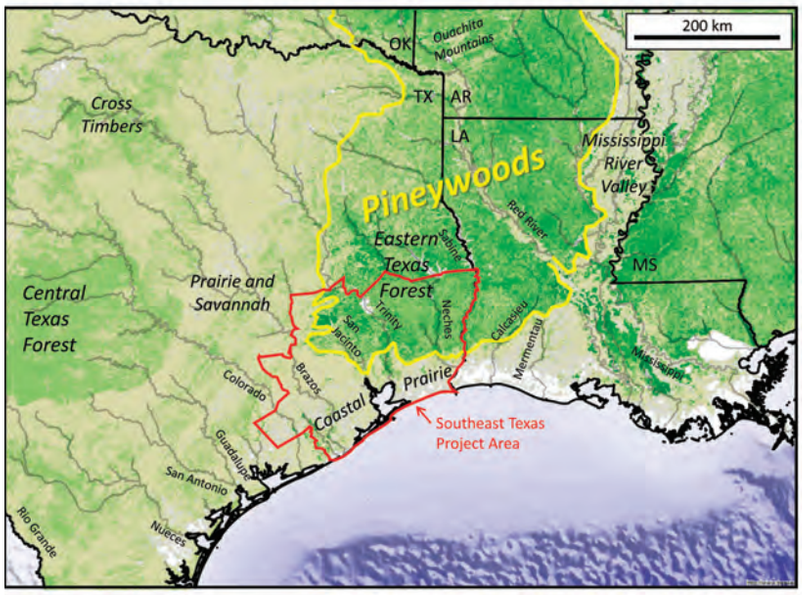



Figure 7.7. An outline of the Piney-woods region of Texas, Louisiana, Arkansas and southeasternmost Oklahoma. The base map shows forest cover, as documented in Figure 7.2.

age (Prewitt 2014, 2017). It has a distinctive stemless leaf shape, and some points show traces of asphaltum used in hafting. Suhm and others (1954) note that it is found widely in the Central Coast zone, extending into the South Texas plains as the map in Frame 32 shows (and even, according to Suhm and others, as far west as the Trans Pecos). It is a minor point style at three locations in the Katy Prairie but has not been observed in the San Bernard Prairie. It has not been extensively dated, but five points at the Lino site in Webb County were related to a radiocarbon date of 3200 BP (Quigg et al. 2000). Large versions of this point style were probably knives (Turner et al. 2011).

**Morhiss.** The Late Archaic Morhiss point (Frame 33) is named for the Morhiss archeological site in Victoria County (41VT01). It is a rather heavy point, found mainly along the central coast and the Guadalupe River (Turner et al. 2011), but also along the Nueces and San Antonio rivers in South Texas as well as in the San Bernard and Katy prairies. It is a minor type of the Central Coast-South Texas Tradition in Southeast Texas and is uncommon farther inland (Suhm et al. 1954), although Prewitt (1995) shows its distribution reaching as far as the Balcones Escarpment. It does not range into the East Texas forest or its rivers. Burials at the Loma Sandia cemetery site in Live Oak County (41LK28) include Morhiss points; the burials have been dated at ca. 850–550 BC (Dockall and Black 2006). A few Morhiss points made it all the way to the Poverty Point prehistoric mound complex in Louisiana, probably as trade goods (Ford and Webb 1956). Morhiss points found at the Morhiss site are in association with marine shell ornaments made from *Busycon*, the lightning whelk. These worked shells are also noted at several cemetery sites in the area of the San Bernard Prairie and appear to have been widely used as exchange goods (Chapter 11).

**Catán and Guerrero.** The remaining two points styles, Catán and Guerrero, along with Refugio points, are examples of what has been termed the "Unstemmed Point Tradition" of South Texas. The term refers to the fact that point styles in South Texas and adjacent parts of northeastern Mexico are typically made without stems, probably as a result of the small size of local pebbles and small cobbles used to produce them (Black and Quigg 2006).

The Latest Archaic through Late Prehistoric Catán type (Frame 34) is leaf-shaped and stemless. It is found along the central coast but also extends into northern Mexico (Turner et al. 2011). The Catán type is rare in Southeast Texas and hence not captured in the project database; for that reason it is not entered in the chronology chart of Figure 7.3. It has been found at only a few sites in the San Bernard Prairie as well as the coastal Fullen site (41HR82), a shell midden along Clear Lake. Along Peach Creek in the San Bernard Prairie (sites 41WH10 and 41WH12),

Catán points are found along with Cuney, Bulbar Stem, and Lozenge points (all rare in Southeast Texas) in a Late Prehistoric site associated with the Karankawan Coco band of the early Historic Period (Patterson and Hudgins 1989a, 1989b; Patterson 1996).

The Guerrero point is the youngest of the group (Frame 35); it is found at early Historic Period mission sites along the central coast and in Bexar County (Turner et al. 2011), all places associated with efforts to "missionize" Karankawan people. The abovementioned sites in the San Bernard Prairie are close to the Colonial era Post West Bernard of the 1830s, which was involved in efforts to suppress the Karankawa (Chapter 4). Guerrero points have been found there as well; it is the youngest stone point style found in coastal Texas.

### Summary, Central Coast-South Texas Tradition points

Although there is evidence for habitation in the Central Coast-South Texas area at least as far back as 7000 BP (Black and Quigg 2006), points of this tradition that show up in the Southeast Texas project area date only from the Late Archaic. Earlier examples apparently did not reach into the project area. The lifeway of the people of this tradition, as evidenced by ethnohistoric information, was one of coastal fishing and shellfishing, with forays into the interior to gather plant foods and to hunt deer and bison, whenever available (Frame 36). In times of drought, the tree-lined small rivers arriving at the bays formed a refugium, providing the immediate requirements of life: water, food, and shelter. The distribution of points of this tradition suggests that these forager-hunters ranged widely outside of this refugium into inland parts of South Texas and the central coast, typically following the Nueces, San Antonio, and Guadalupe rivers. In the Historic Period the San Bernard Prairie was part of the home range of the Coco band of the Karankawa, tied to sites where Guerrero and Catán points have been found. The Coco people represent the northernmost outpost of people of the tradition, and are linguistically and culturally distinct from the Atakapa of the upper coast, as has been discussed.

When the Coco and their immediate predecessors in the Central Coast-South Texas Tradition hunted in the environs of the Colorado River and the San Bernard and Katy prairies, they would have competed with hunters from the Central Texas Balcones and Trinity-Sabine traditions (in early Historic Period, this would have included Tonkawa and Akokisa). In Late Archaic graves in and around that prairie zone, violent deaths were noted at several sites (Chapter 11). Points used in these violent deaths included Gary, Kent, and Yarbrough points from the Trinity-Sabine Tradition as well as a Fairland point from the Central Texas Balcones Tradition (Story 1990; Patterson 2000; Chapter 11).

## Arrow points with expansive distributions

There are two Late Prehistoric Period arrow points that have exceptionally large distributions, captured in this category. Their range is larger than can be accounted for within either the Central Texas Balcones or the Trinity-Sabine traditions, suggesting that either trade or the movement of people was involved in their distribution.

**Scallorn.** The Scallorn (Frame 38) is a small, triangular-shaped arrow point

with pronounced barbs and an expanding stem (Suhm et al. 1954). Story (1990) places its range as ca. 1300 to 800 BP. Collins and others (2011) note that this was the first major arrow point to appear in Central Texas, representing a significant shift in technology, and that these points are quite frequently found in burial contexts, suggesting violent deaths during a time of strife, when—unlike during the slightly later time of Alba and Perdiz point styles (according to Shafer 2006)—bison were relatively scarce. Scallorn points have a strong focus along the Balcones Escarpment (Frame 38) but are also very common in Southeast Texas, where they are found extensively in the Katy and San Bernard prairies and also, less frequently, along the Trinity and Neches rivers. Scallorn points were found at the Witte site (41AU36) along the rim of the Brazos River at the edge of the San Bernard Prairie associated with a burial that resulted from a violent death (Hall 1981; see Chapter 11).

Scallorn points have an extremely wide distribution (Frame 37). Late Prehistoric Scallorn points are extensively distributed across Texas, extending as far west as the New Mexico border, as far north as the Panhandle, and as far south as the Rio Grande (Prewitt 1995). In Louisiana they are found at Fort Polk in the western part of the state (Anderson and Smith 2003) as well as at Avery Island in southwest Louisiana (Gagliano 1967). Scallorn points have been found in eastern Kansas (Kansas Historical Society, n.d.) and in southwest Missouri at the Big Eddy site (23CE426); Chapman (1980) reports that they are widespread in Missouri. In the Missouri Ozarks, Scallorn points tend to be Late Woodland, continuing into the Mississippian (Lopinot et al. 1998), and are associated with Caddoan presence there (Ray 2017). They are found as far northeast as the upper Mississippi Valley (Larsen n.d.). As an early point style associated with newly arriving bow and arrow technology, it seems possible that the Scallorn was widely traded or copied.

**Perdiz.** Trading seems clearly to have been carried on with the Perdiz point. The Perdiz point is considered by Collins and others (2011) to be a Central Texas point, and indeed it has a strong presence along the Balcones Escarpment (Frame 39). It is also a frequently encountered point type, however, in West Texas, South Texas, and in Southeast Texas (Frame 37). In Southeast Texas it is found at most sites in the San Bernard and Katy prairies as well as in great numbers along the Trinity and Neches rivers. It is found at the Fort Polk site in nearby western Louisiana (Anderson and Smith 2003). About the only portion of the state of Texas in which the points are not found is the extreme northern Panhandle (Frame 37). The point's age range is very late in Late Prehistoric time (Figure 7.3; Collins et al. 2011); of the parts included in the project chronology, only the Guerrero "Mission" point is younger.

According to Story (1990), Perdiz points are thought by Kelley (1986) to have originated in the Rio Grande Valley, and were dispersed widely by the Jumano Indians, a group of uncertain lineage who lived in early Historic Period in the area between the lower Pecos River and the Colorado River, where they were known as regional traders and bison hunters (Hickerson 2020). Spanish accounts show that the Jumano participated in annual trading fairs with people as far east as the Caddos and Wichitas of northeast Texas (Chapter 4; also see Atlas V, Frame 9, sites 3 and 4). As Story notes,

> *Kelley's hypothesis . . . outlines specific processes that might account for such a rapid and widespread (but well-defined) dissemination of a point style. It also calls attention to the late prehistoric (after ca. AD 1200 or 1300) importance of bison hunting and trading of bison products, a situation which may have furthered the spread of Perdiz type independent of the Jumanos.* (Story, 1990)

The Bassett point style (not shown) is coeval and perhaps slightly younger than the Perdiz, and is very similar in form; it could be confused with Perdiz (Anderson and Smith 2003). It is found in low numbers in the East and Southeast Texas forest, according to Prewitt (1995). The Bassett is linked to the Caddo, and may have developed out of early Perdiz points, according to Story. Bassett as well as Perdiz points are found at Fort Polk, and Swanton (1946) has pointed out—from some of Dyer's (1917) reporting—that Avoyel Indians of the Lower Mississippi Valley were also very active in trading in early Historic time; they reportedly "acted as middlemen who obtained worked or unworked flint from the Arkansas Indians about the Hot Springs and passed it on to the Chitimacha and Atakapa on the coast, these last supplying the Karankawa further west. . . . [They] were actively engaged in trading flints—so actively that they were known as the 'Flint People'." By such means—either by trade or by adoption of the Perdiz shape by Caddoans of East Texas and Louisiana—the expansive and unfocused nature of the Perdiz distribution can potentially be understood.

Because of these expansive distributions, these point styles are not included in the paleogeographic maps of Atlas IV, because they add little clarity to known or suspected cultural boundaries.

## Points of uncertain or problematic classification

There is yet another group of point styles, all of Late Archaic and younger ages, with distributions that defy the fairly straightforward geographically based characterizations of the preceding four traditions. Some of these points are standard point styles in Central Texas or elsewhere, but their distribution patterns in Southeast Texas, for one reason or another, are problematic or at least potentially blurred by closeness in form to other existing local styles. This blurring makes them poor candidates for use in paleogeographic mapping (Atlas IV and Chapter 10).

**Bulverde.** The Bulverde point (Atlas II, Frame 40) shows a very clear focus along the Balcones Escarpment, where its temporal span is estimated at about 4000–3500 BP (Collins 2004), younger than Travis and just older than Pedernales (Figure 7.3). That strong focus at the Balcones Escarpment suggests a classification as a Central Texas Balcones Tradition point style. However, its distribution in Southeast Texas and elsewhere is unexpectedly and inexplicably broad (Collins 2011). In particular, it is found in robust numbers along the Trinity River, within the refugium of the Trinity-Sabine Tradition. Does this represent a possible Central Texas cultural incursion into the heartland of the riverine Trinity-Sabine Tradition, ore widespread trading? There is at least one other possible solution. The Bulverde has a triangular shape, slightly convex, with an often long, rectangular stem, as shown in the illustration of Frame 40. In this, it is quite similar to the Carrollton point of the Trinity-Sabine Tradition (compare with the Carrollton point drawing, Frame 22). The

main difference between the two, according to Suhm and others (1954), is that the stem on the Carrollton is smoothed by grinding (also see Crook et al. 2017). That difference is subtle. Most of the Trinity River collections, as mentioned, are surface collections, which would not allow potential observation of stratigraphic relative age difference between Bulverde (early Late Archaic) and the older Carrollton (late Early Archaic) points. A working hypothesis is that the Bulverde, sensu stricto, is a Central Texas Balcones Tradition point, the distribution pattern of which is marred by interference in identification with Carrollton points in much of the deep East Texas forest. Those Bulverde points shown in the Katy and San Bernard prairies would be expected of any Central Texas Balcones Tradition point, as a result of bison hunting forays that travelled eastward along the Colorado River—although there is potential for classification issues there too, of course.

**Ellis.** In Southeast Texas, Ellis points are present at many sites along the Trinity, Neches, and San Jacinto rivers as well as at hunting sites in the Katy and San Bernard prairies (Frame 41). This point style is found deep into the Lower Mississippi Valley, where it is locally a predominant style. Ellis points are the second most frequent point style at Poverty Point, and are also present at Jaketown, both in the Lower Mississippi Valley region of northeast Louisiana and western Mississippi (Ford and Webb 1956; Lauro and Lehmann 1982). They are in the lower part of the Mississippi River Valley at a Tchefuncte culture site at Big Oak Island near New Orleans (Hays and Weinstein 2010). They are present at several places in Caddo Parish, Louisiana (Ford and Webb 1956), and Ellis points constitute the major point style at Avery Island in coastal south Louisiana (Gagliano 1967). From these observations, a classification with the Trinity-Sabine tradition would be supported.

However, Ellis points are also found in central and far west Texas (Prewitt 1995), but the far western extent of Ellis is debatable; Turner and others (2011) observe that Ellis points are potentially confused there with the Southwest Texas Zavala point as well as—in general—with Edgewood and Marcos points. The extent of that potential confusion is difficult to measure, but it seems unlikely that there is great cultural significance to a point type stretching from the lower Mississippi delta to New Mexico. For that reason, it seems best to place its distribution as potentially "problematic."

**Williams and Palmillas.** The Williams point is Late Archaic Ceramic in age (Collins 2004). Its distribution has a focus in both Central Texas and the Katy and San Bernard prairies as well as the Trinity and Neches rivers (Frame 42). Suhm and others (1954), consider this a Central Texas point style, noting that distribution is somewhat blurred by closeness in form to Marcos and Castroville points. It is also quite similar in form to that of the Late Archaic Palmillas point (compare Frames 42 and 44). The distribution of the Palmillas point is poorly defined and lacks a particular focus anywhere in Texas. It is found in numbers along the Trinity River in Southeast Texas but as far west as El Paso (Prewitt 1995). It has been described in large numbers at Fort Polk in west-central Louisiana (Anderson and Smith 2003), in appreciable numbers at Avery Island in southwest Louisiana (Gagliano 1967), and in small numbers at Poverty Point in the Lower Mississippi Valley (Ford and Webb 1956). At Fort Polk it has sometimes been confused with a point style called Lone Oak, and that type name has now been discarded. Anderson and Smith (2003)

recommend the avoidance of use of the Palmillas type:

> *The* [Palmillas] *type is considered to be poorly defined and overly general, encompassing a range of forms and reflecting various skills in execution. . . . Palmillas types are widely reported from southern Tamaulipas across eastern Texas and Louisiana . . . although given the poor definition, exactly what such a distribution means is unclear. . . . Given its ambiguous description, the type name should be avoided in future studies.*

With this in mind, both Williams and Palmillas are ranked as potentially problematic types for the purposes of this study and its paleogeographic maps.

**Ensor.** In Central Texas the Late Archaic Ensor point is associated with a prominent mesic (moist) interval at ca. 1400–2600 BP (Collins et al. 2011). An Ensor point is associated with Burial Group 2 at the Witte site (Hall 1981), dated at between 1650 and 2450 rcyBP, similar to the age range for the point estimated by Collins and others.

The Ensor distribution pattern is broad across Texas and parts of Louisiana (Frame 43). Prewitt (1995) places it from far west Texas to the Sabine. In detail, its focus seems clearly to be along the Balcones Escarpment, which would suggest its placement in the Central Texas Balcones Tradition, and indeed it is typically ranked as a Central Texas point (e.g., Collins et al. 2011). However, it has also been described in a number of locations in Louisiana. Ford and Webb (1956) place it at Poverty Point in the Lower Mississippi Valley of northeast Louisiana, and Anderson and Smith (2003) place it at several sites in the Fort Polk area of Louisiana, just west of the Red River, with robust numbers of points. The map in Frame 43 shows that within the Southeast Texas area, it occurs prominently not only in the Katy and San Bernard prairies, where a Central Texas point would be expected, but in heavy numbers along the lower Trinity River, where it would not be expected.

The problem may relate to issues in typology, in Texas and Louisiana practices. At Fort Polk, Ensor points are dated as part of a cluster of points at ca. 6300 to 3700 BP, and a heat-damaged Ensor point beneath a radiocarbon-dated hearth yielded a date of 5916 BP (Anderson and Smith 2003), considerably older than the Central Texas and San Bernard prairie dates already mentioned. It would seem to Anderson and Smith that there are two separate "Ensors" that look alike but existed at different times and in slightly different locations. Green (1989) has proposed to separate a Louisiana, older, Calcasieu point that has been "misdiagnosed" as Ensor. With further research, the distribution map of Frame 43 may split into Central Texas and East Texas-Louisiana Calcasieu segments.

**Darl.** These points (Frame 45) were among the last dart points used in Texas, occurring just before the arrival of bow and arrow (and hence arrow point) technology in Southeast Texas at the beginning of the Late Prehistoric. They date to the end of a mesic interval when bison resources were meagre (Collins et al. 2011). Darl distribution is focused around the Balcones, and the points radiate outward from there. The occurrence of a number of Darl-identified points at several locations along the Trinity River is surprising. This point style was noted by Suhm and others (1954) as being very close in form to the contemporaneous Trinity-Sabine Yarbrough point (Frame 27), as a comparison of the two images underscores. Darl

would appear to be a Central Texas Balcones Tradition style, but with potential classification overlap with Yarbrough that might explain its unexpected presence along the Trinity.

In summary, this grouping includes points that seem to suffer from unfocused distribution, thought in most cases to result from confusion with other point styles, at least within Southeast Texas. Closeness in form between point types is suggested as the main potential reason for the confusion, and these point types are not used in the paleogeographic maps discussed in Chapter 10.

## A summary model for projectile point traditions

The regional map in Frame 46 contains a notional model of three main post-Paleoindian regional point traditions and their relationship to bison hunting on the Texas plains, from the beginning of the Early Archaic until the early Historic Period. There are three principal refugia in central and eastern Texas that appear to have been resilient enough in resources to permit cultures to persist through intermittent dry periods, when water was scarce in most of the state and bison were not abundantly present. The refugium of the Central Texas Balcones Tradition lies within the confines of the spring-watered canyonlands of the Balcones Escarpment, which allowed occupation in both dry and moist climatic periods. The relatively large Trinity and Sabine rivers and their San Jacinto and Neches tributaries within the East and Southeast Texas forest provide another resource-rich niche, foundational to the Trinity-Sabine Tradition. Finally, the brackish water bays of the central Texas coast, watered by small rivers and graced by abundant brackish water fish and shellfish, provided a third resource-rich zone, the refugium of the Central Coast-South Texas Tradition. Each of these three ecological niches supported long-term human occupation. In between these resource areas, the prairies and savannahs of the Texas plains would have provided a sun-baked, challenging environment during periodic droughts. However, during periodic wetter climatic periods, bison moved down from the southern Great Plains in herds of thousands, producing an abundant food resource that outstripped each of the three niches described. During these times, it is reasonable to assume that the people of each of these traditions tooled up with projectile points using largely local lithic resources, formed mobile hunting groups, and went out into the adjacent plains to hunt. At their kill sites, processing sites, and campsites, they left behind lithic evidence of their former periodic presence.

As the map shows, the Katy and San Bernard prairies are unique in that they are the only known places where people of all three of the abovementioned Archaic and younger traditions periodically camped (and presumably hunted) throughout the Early Archaic through early Historic periods—not to mention the Paleoindian Period Great Plains Tradition hunters, who also camped there. In the next chapter the archeology of these sites is presented, along with ethnohistorical sources that describe the hunting of both bison and deer in these two prairies.

# Atlas II:
# Distribution maps of selected projectile points

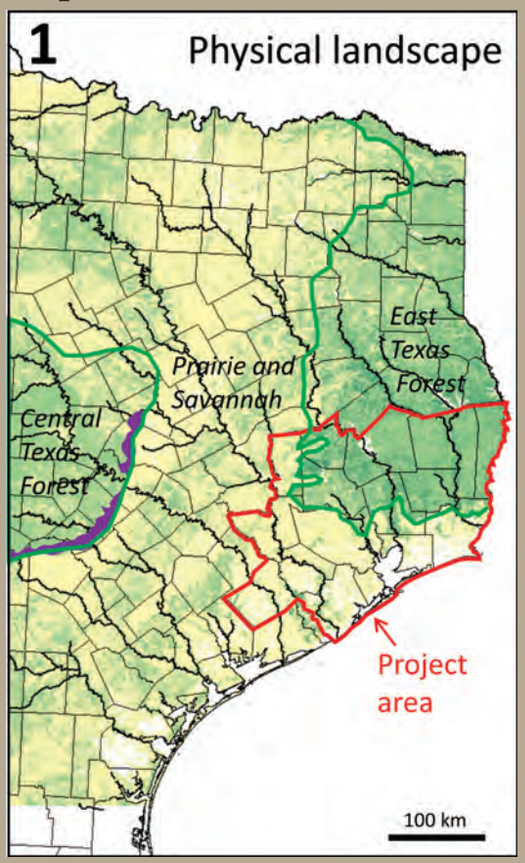
Projectile point distributions are compiled from the following sources:

1. Continent-wide maps:
   - Clovis, Folsom: David G. Anderson and others (2011) and the Paleoindian Database of the Americas
   - Plainview, Scottsbluff, Angostura: Larsen, n.d.
   - San Patrice: Jennings (2010), Jodry and Owsley (2014); and this report
   - All others: Compiled and modified from Prewitt (1995), Collins and others (2011) and Larsen, n.d.

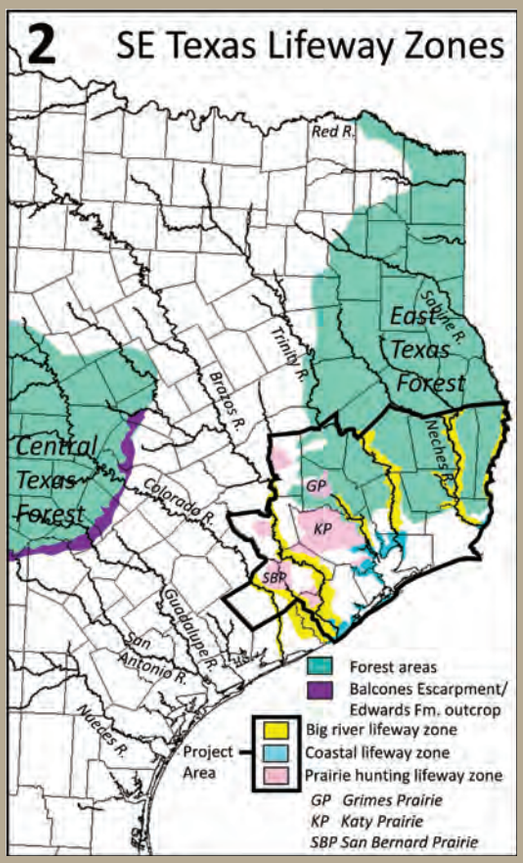
2. Eastern Texas maps:
   Parts of the maps lying outside of Southeast Texas project area:
   - Prewitt (1995), principal reference for counties containing points
   - Story (1990), and Bousman and others (2004, point data outside of Southeast Texas
   - Turner and others (2011), general reference

   Parts of the maps lying within the Southeast Texas project area:
   - Patterson (1989 a and b, 1996) as updated for this project, the above-mentioned sources, and various other sources mentioned in the text

## Index Maps:

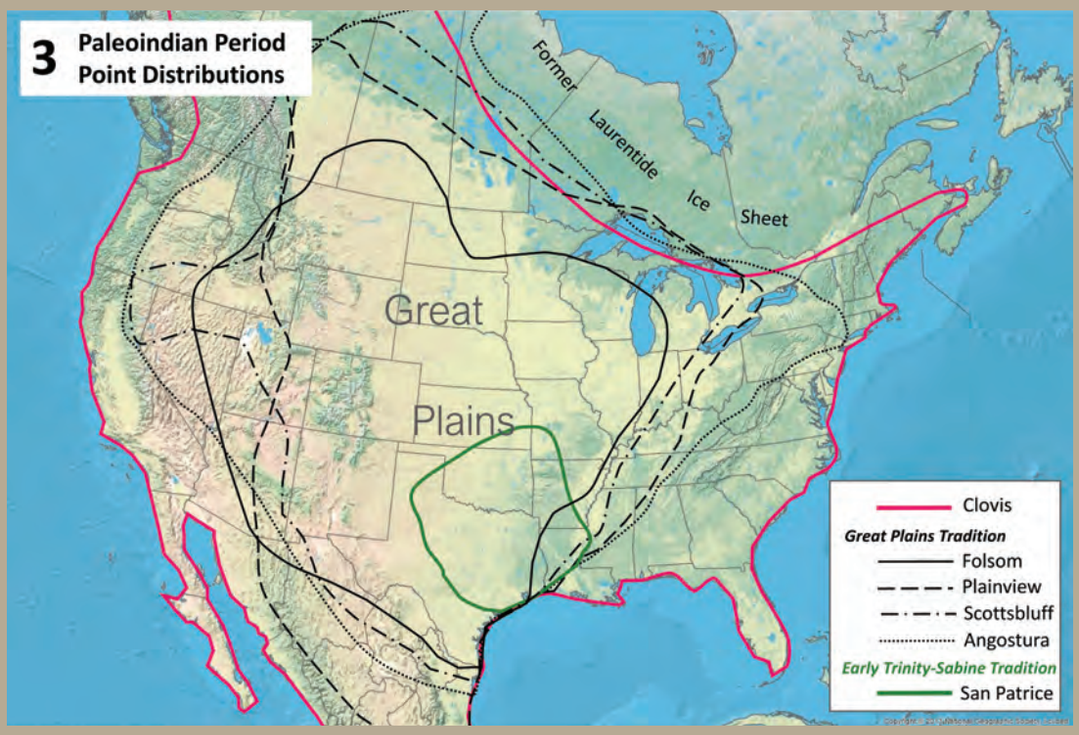


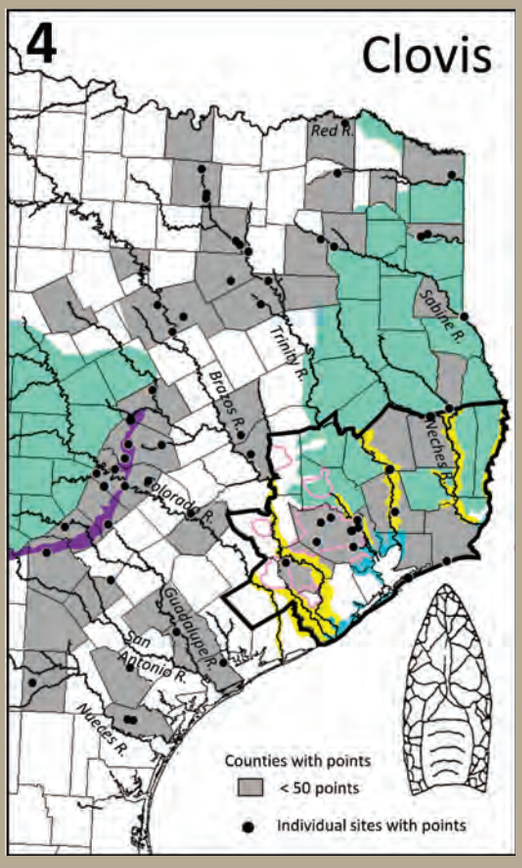

Intensity of forest cover, from Wilson and others (2013), U.S. Forest Service. Modern forests are deep green, and plains, prairies and savannahs are yellow to mottled. The two main forested areas in Central and East Texas are circled in blue-green.

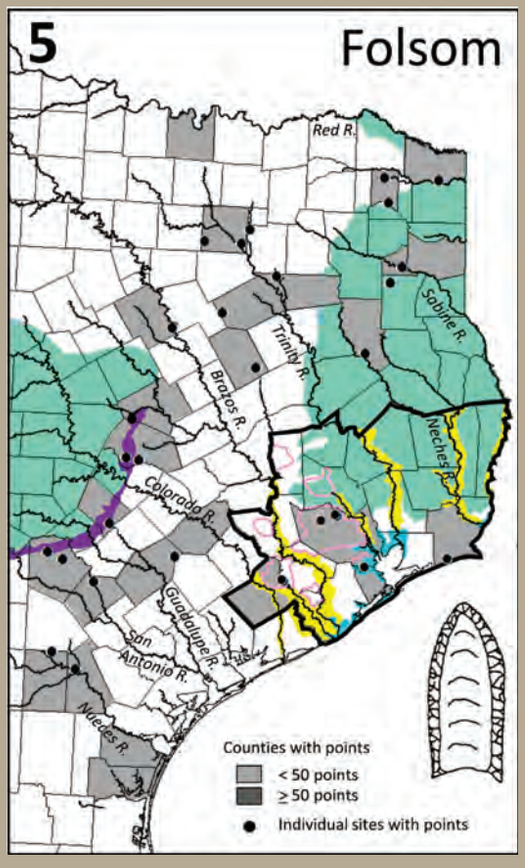


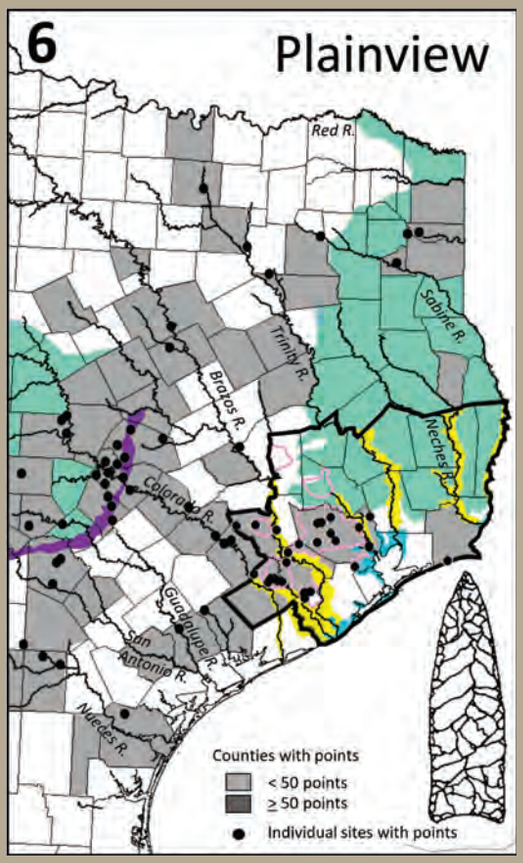

Underlay for projectile maps, with main forest areas and the outcrop area for Edwards Formation chert, which outcrops along the Balcones Escarpment at the eastern edge of the Edwards Plateau. Within the Southeast Texas project area boundary, three "lifeway zones" are highlighted (see Figure 7.1).

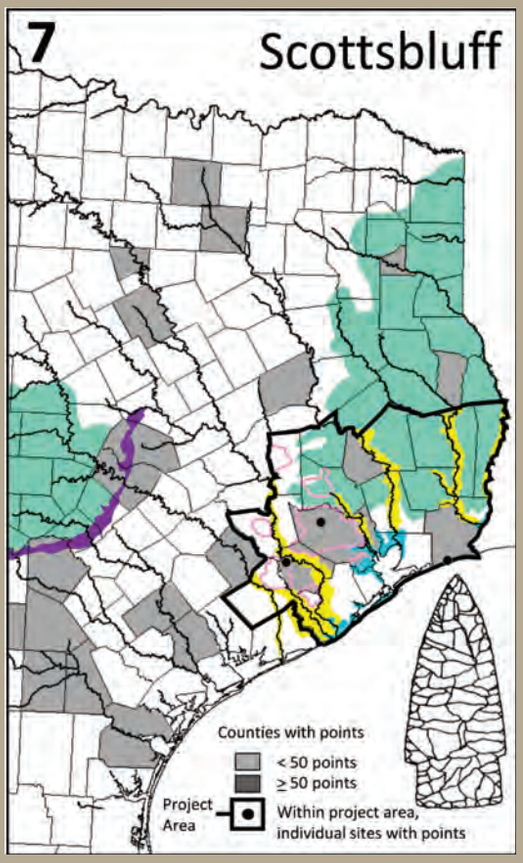
# Paleoindian Period

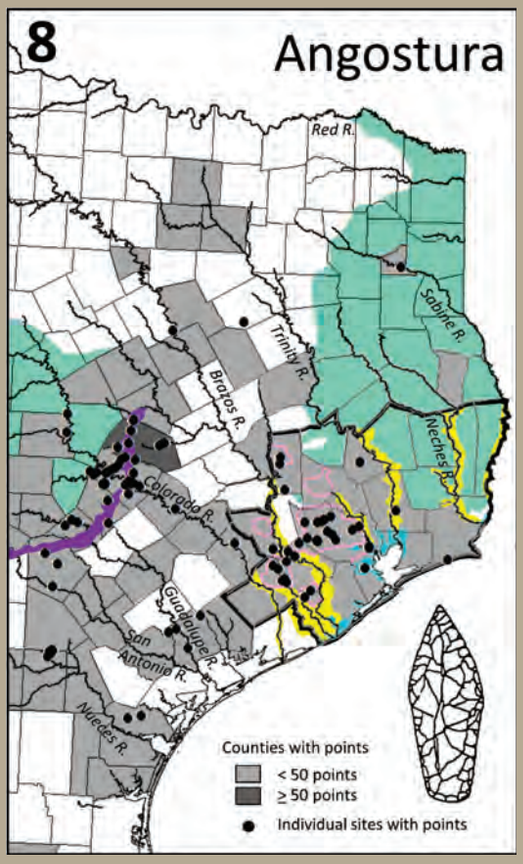


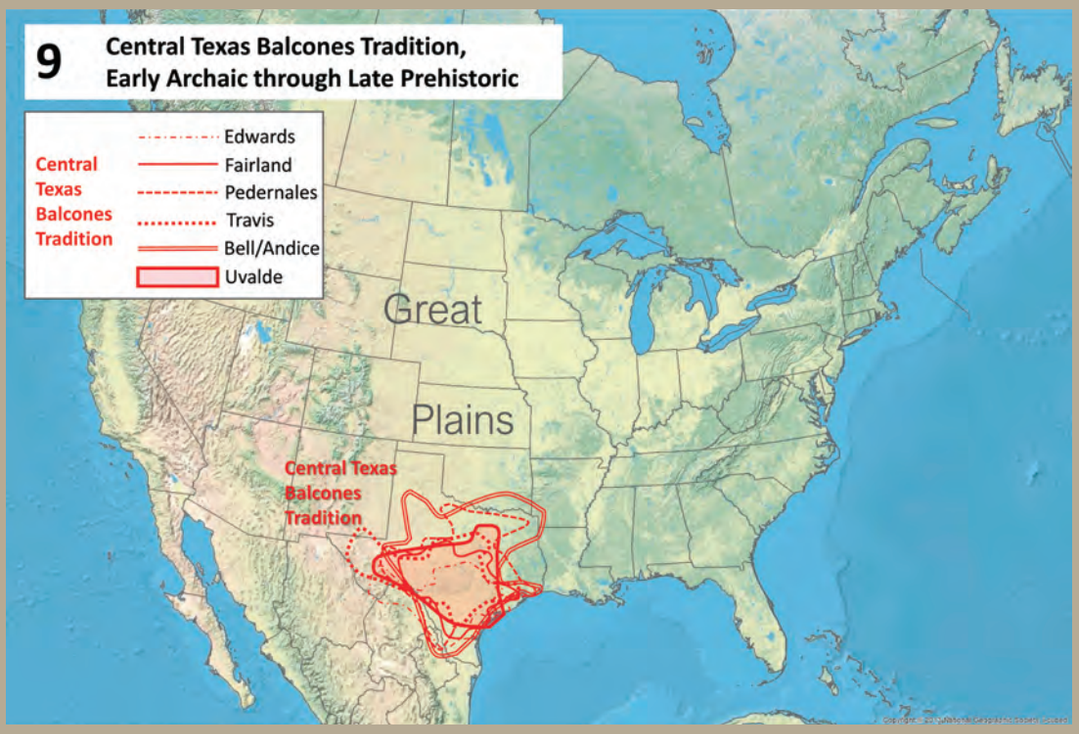



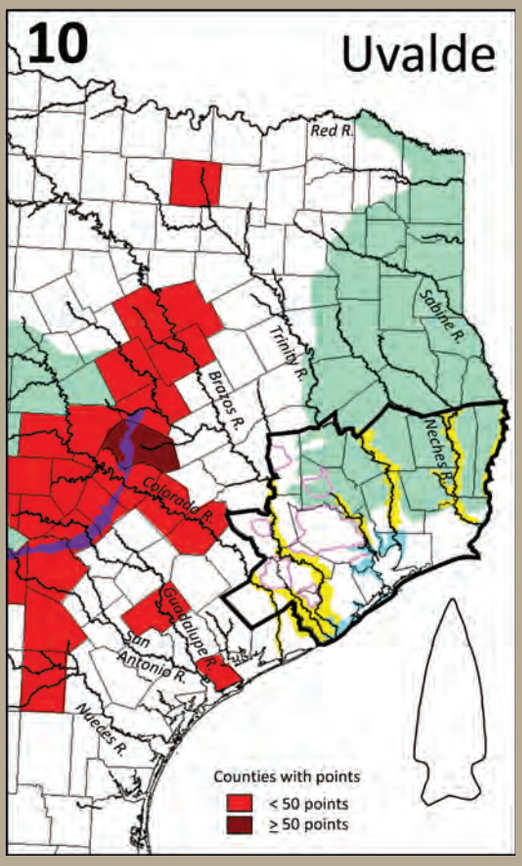

6
Plainview
Red R.
Sabine R.
Trinity R.
Brazos R.
Neches R.
Colorado R.
Guadalupe R.
San Antonio R.
Nueces R.
Counties with points
< 50 points
≥ 50 points
Individual sites with points

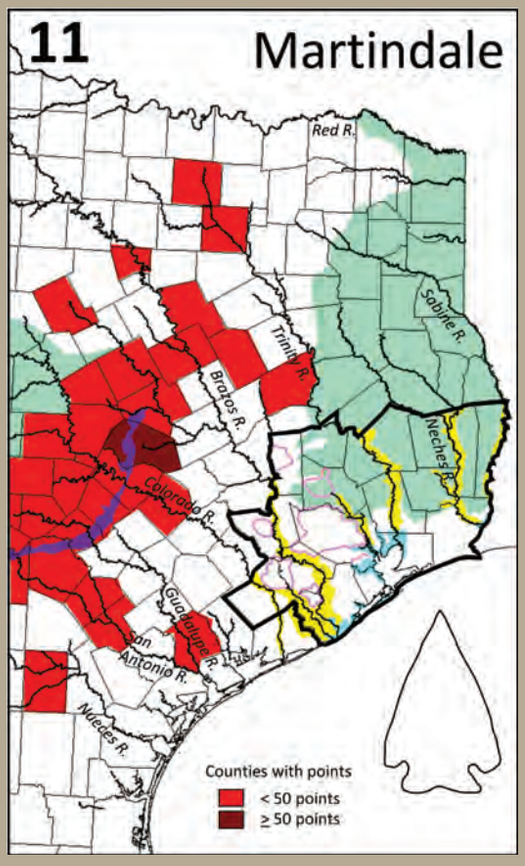

7
Scottsbluff
Counties with points
< 50 points
≥ 50 points
Project Area
Within project area, individual sites with points

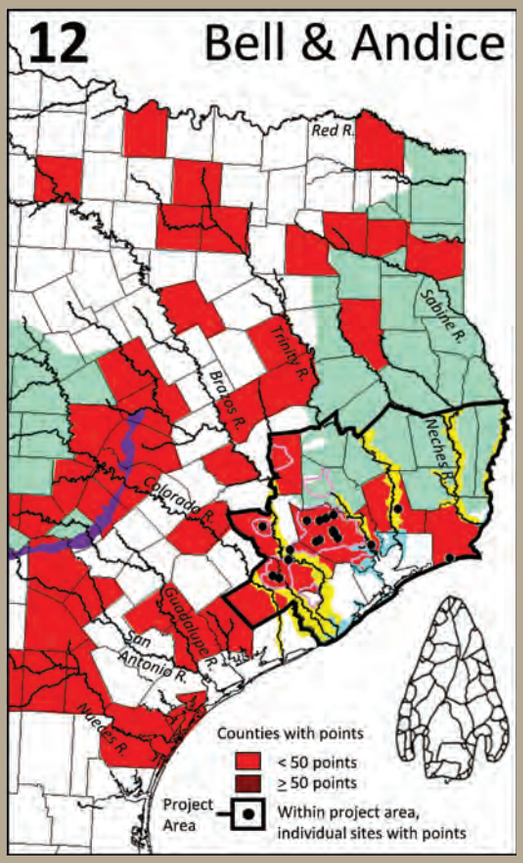

8
Angostura
Red R.
Sabine R.
Trinity R.
Brazos R.
Neches R.
Colorado R.
Guadalupe R.
San Antonio R.
Nueces R.
Counties with points
< 50 points
≥ 50 points
Individual sites with points

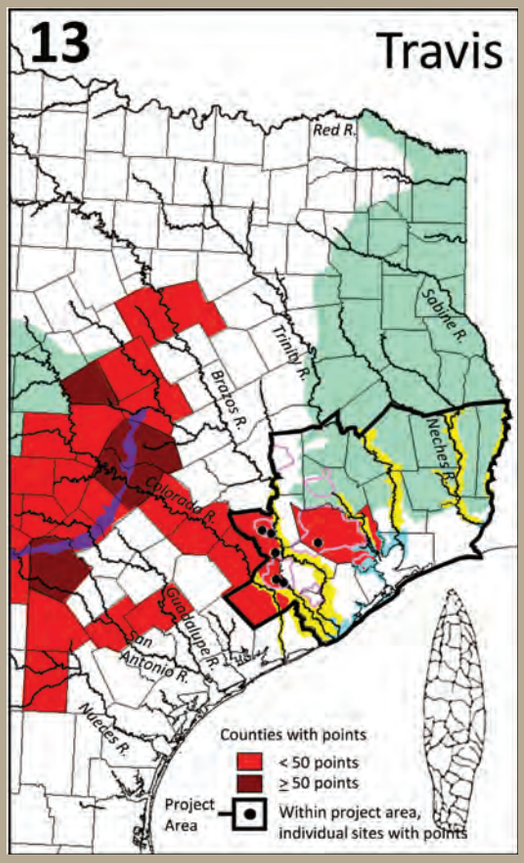
# Central Texas Balcones Tradition

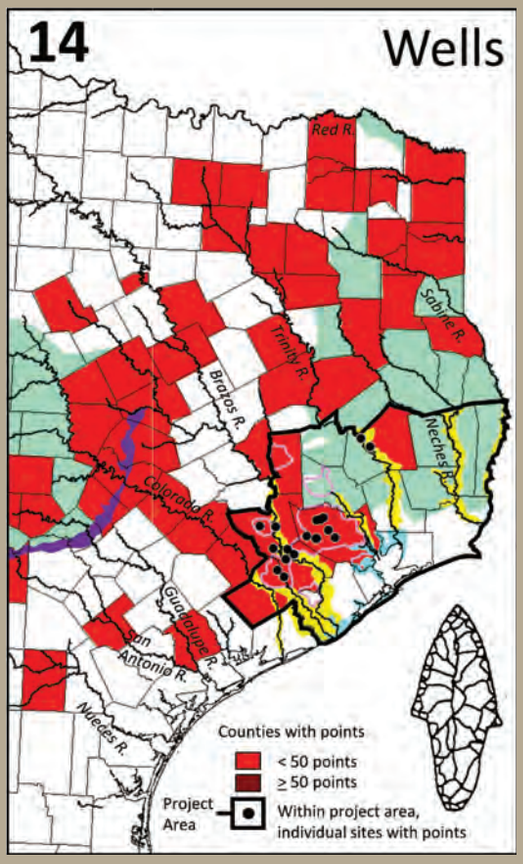


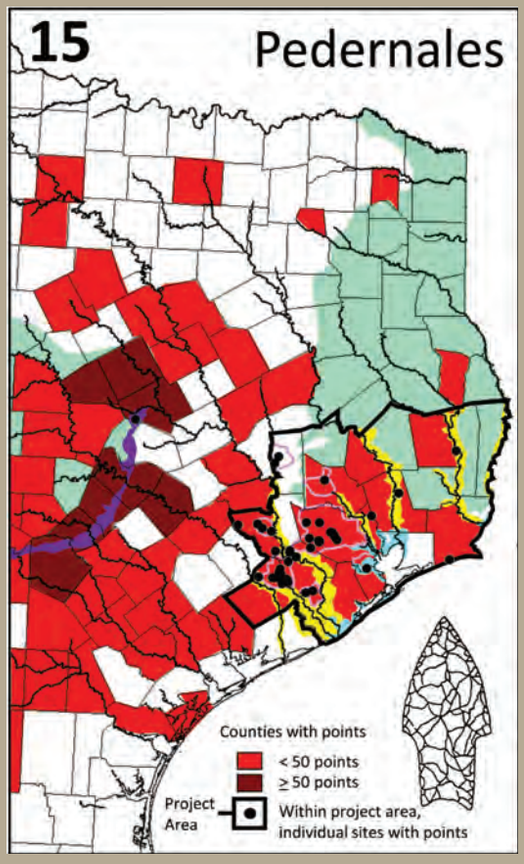



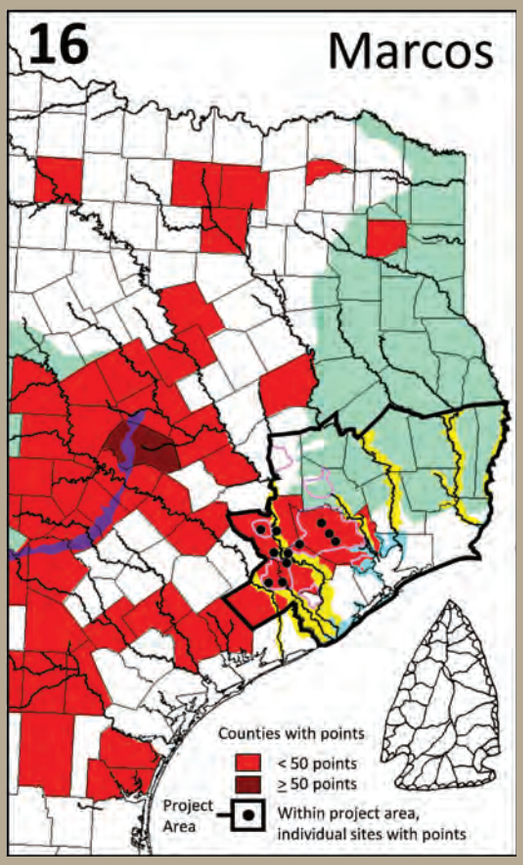



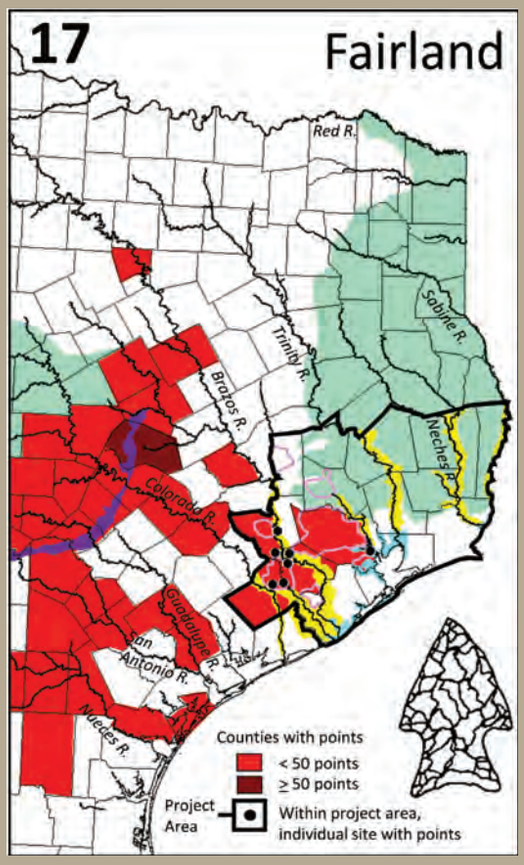

12
Bell & Andice
Red R.
Sabine R.
Trinity R.
Brazos R.
Neches R.
Colorado R.
Guadalupe R.
San Antonio R.
Nueces R.
Counties with points
< 50 points
≥ 50 points
Project Area
Within project area, individual sites with points

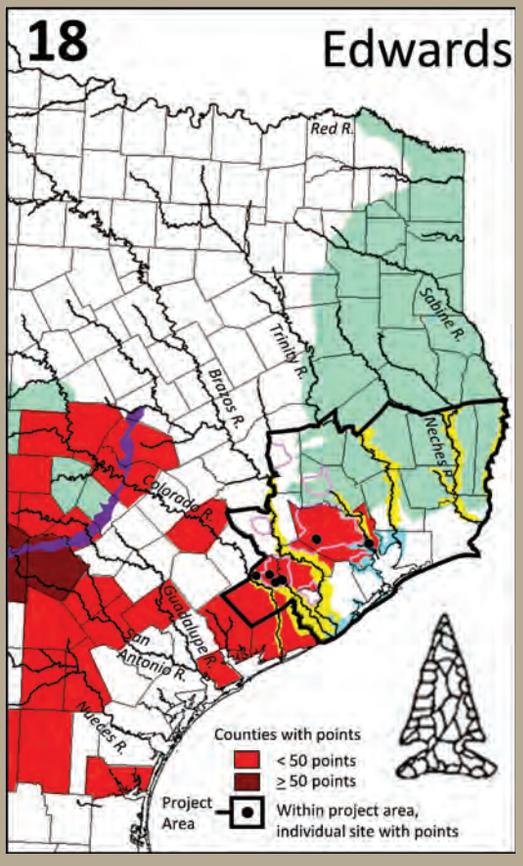

13
Travis
Red R.
Sabine R.
Trinity R.
Brazos R.
Neches R.
Colorado R.
Guadalupe R.
San Antonio R.
Nueces R.
Counties with points
< 50 points
≥ 50 points
Project Area
Within project area, individual sites with points

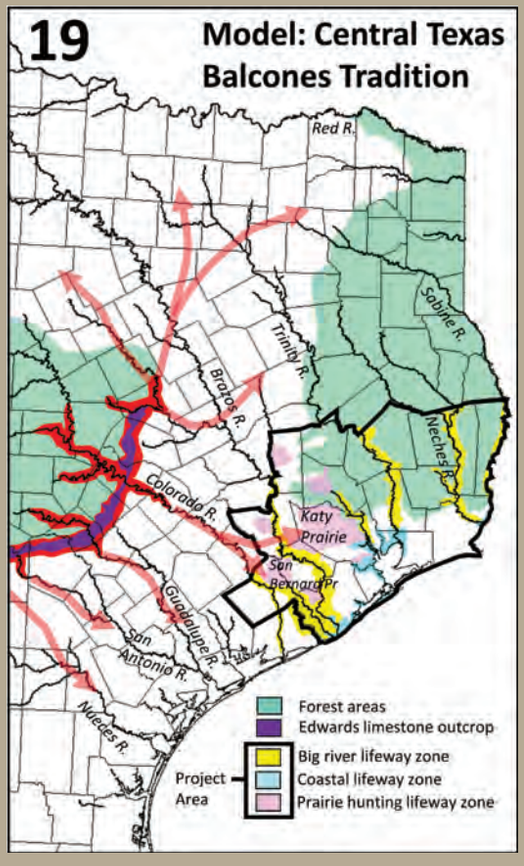

14
Wells
Red R.
Sabine R.
Trinity R.
Brazos R.
Neches R.
Colorado R.
Guadalupe R.
San Antonio R.
Nueces R.
Counties with points
< 50 points
≥ 50 points
Project Area
Within project area, individual sites with points


15
Pedernales
Red R.
Sabine R.
Trinity R.
Brazos R.
Neches R.
Colorado R.
Guadalupe R.
San Antonio R.
Nueces R.
Counties with points
< 50 points
≥ 50 points
Project Area
Within project area, individual sites with points

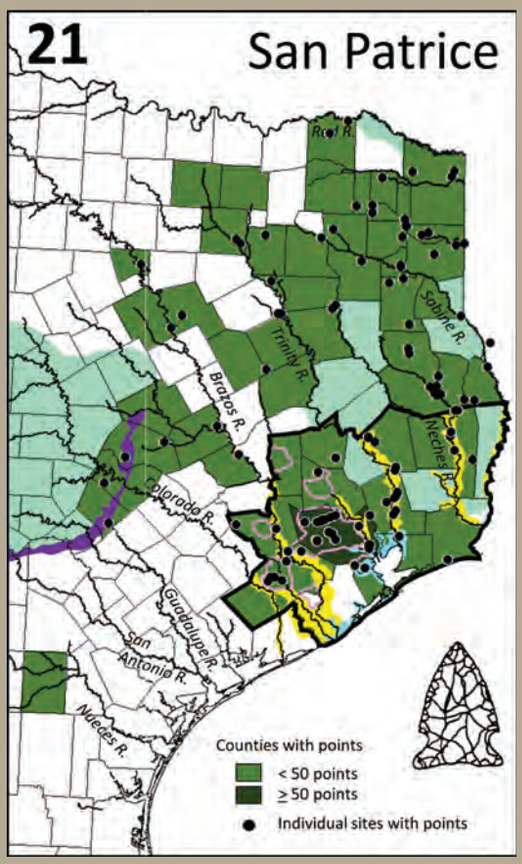

16
Marcos
Counties with points
< 50 points
≥ 50 points
Project Area
Within project area, individual sites with points

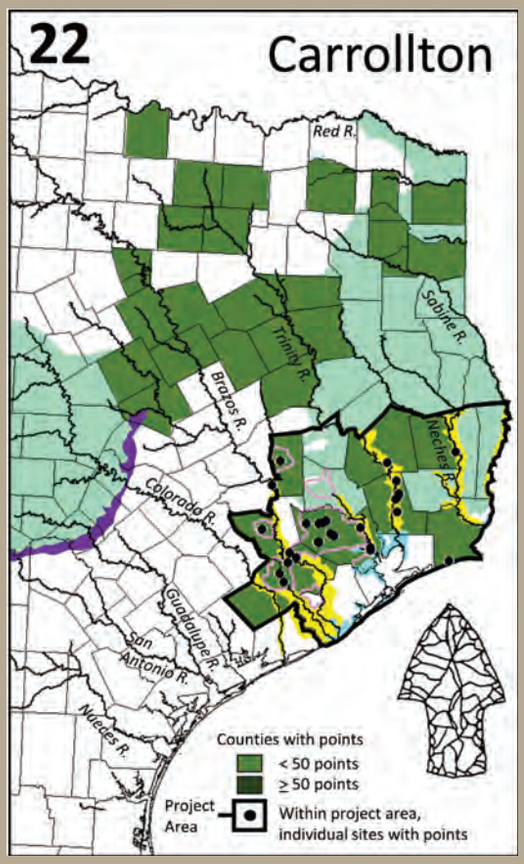

17
Fairland
Red R.
Sabine R.
Trinity R.
Brazos R.
Neches R.
Colorado R.
Guadalupe R.
San Antonio R.
Nueces R.
Counties with points
< 50 points
≥ 50 points
Project Area
Within project area, individual site with points

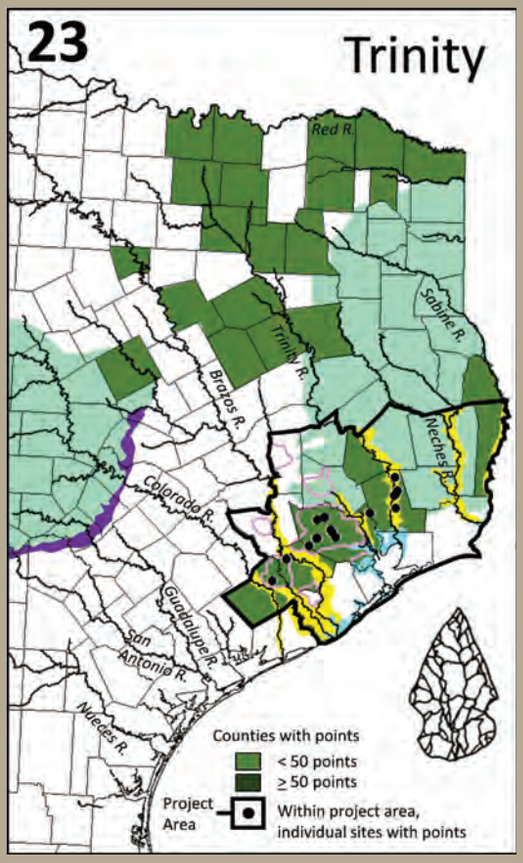

18
Edwards
Red R.
Sabine R.
Trinity R.
Brazos R.
Neches R.
Colorado R.
Guadalupe R.
San Antonio R.
Nueces R.
Counties with points
< 50 points
≥ 50 points
Project Area
Within project area, individual site with points

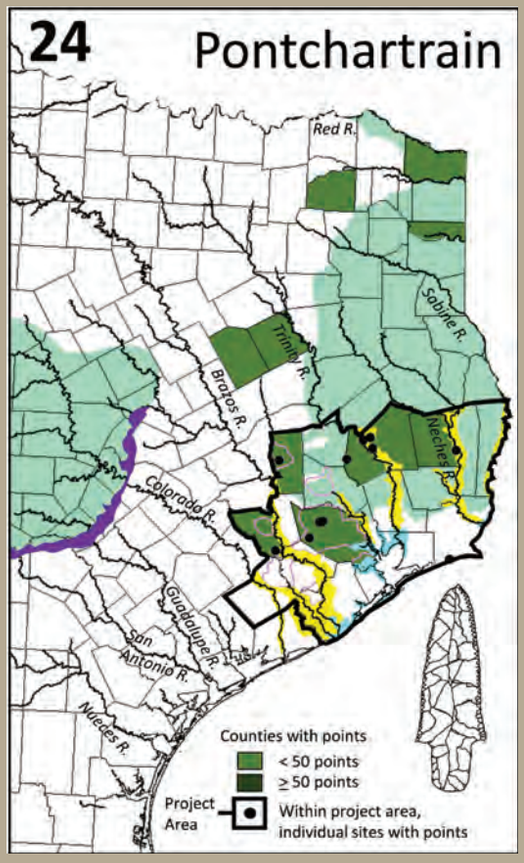

19
Model: Central Texas Balcones Tradition
Red R.
Sabine R.
Trinity R.
Brazos R.
Neches R.
Colorado R.
Katy Prairie
San Bernard Pr
Guadalupe R.
San Antonio R.
Nueces R.
Forest areas
Edwards limestone outcrop
Big river lifeway zone
Coastal lifeway zone
Prairie hunting lifeway zone
Project Area

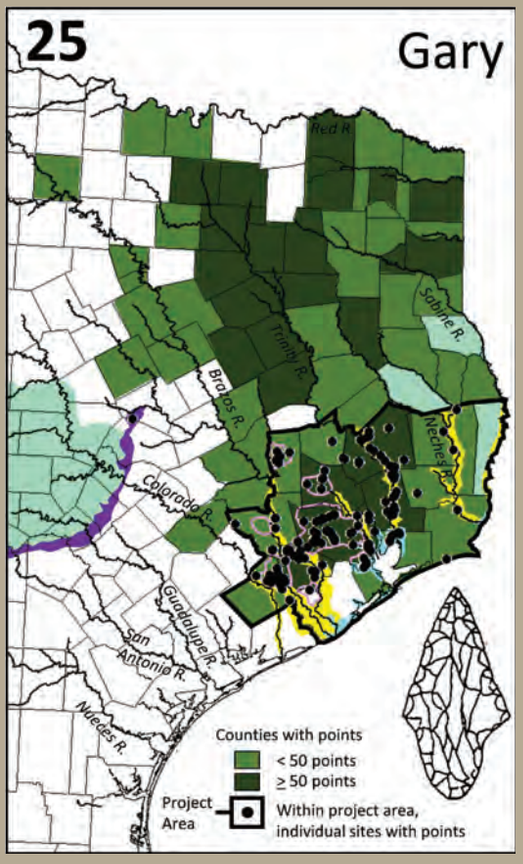
# Trinity-Sabine Tradition

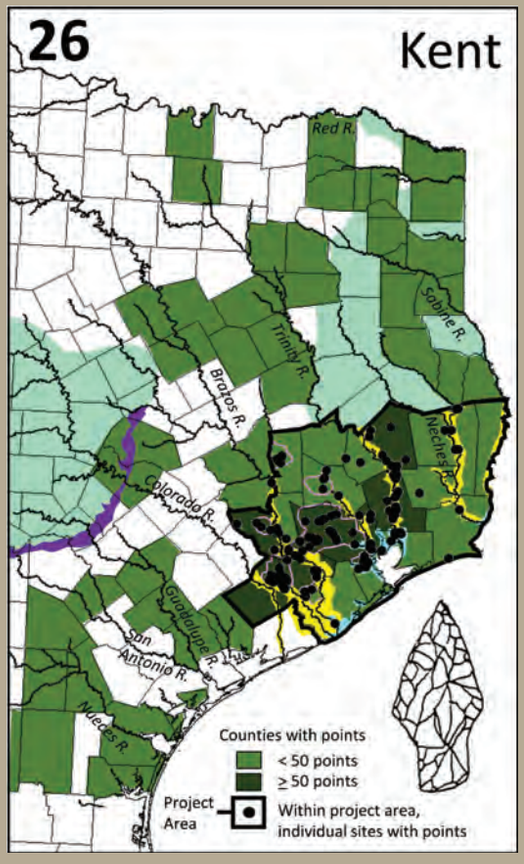


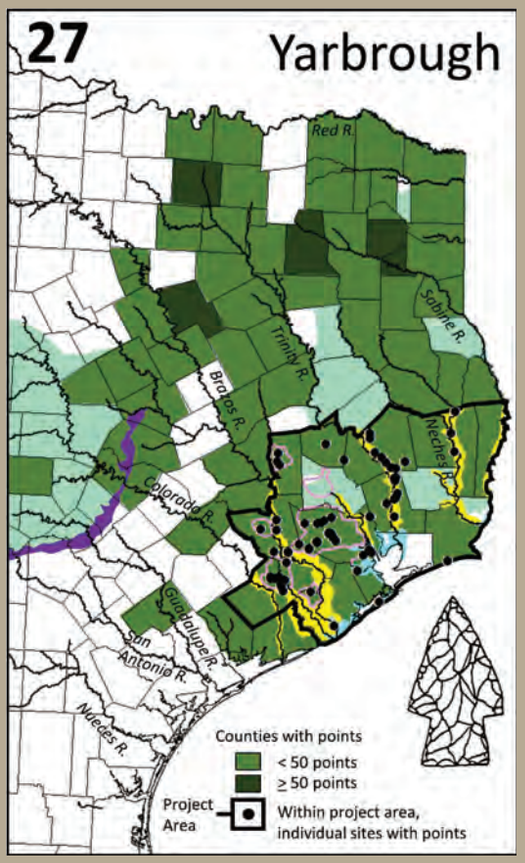



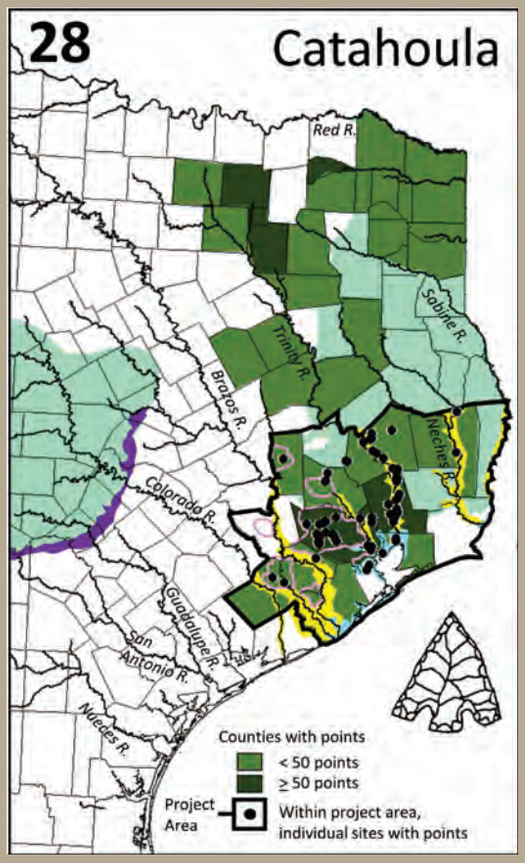

23
Trinity
Red R.
Sabine R.
Trinity R.
Brazos R.
Neches R.
Colorado R.
Guadalupe R.
San Antonio R.
Nueces R.
Counties with points
< 50 points
≥ 50 points
Project Area
Within project area, individual sites with points

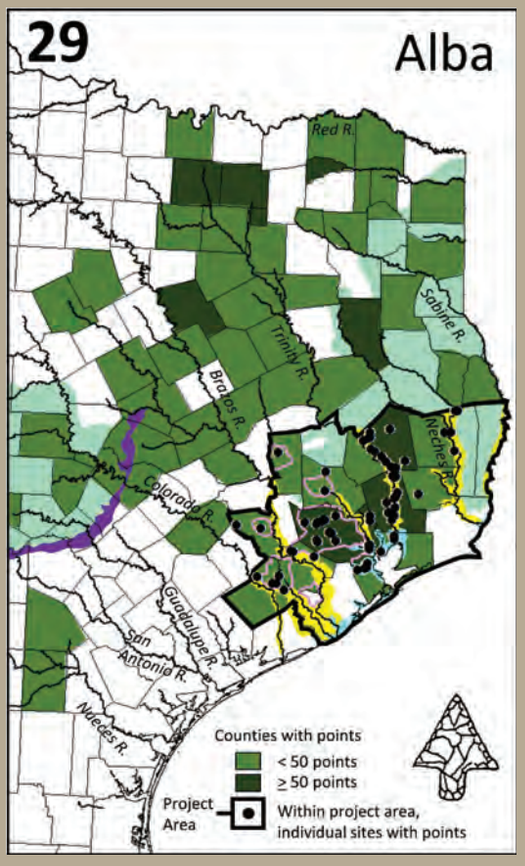

24
Pontchartrain
Red R.
Sabine R.
Trinity R.
Brazos R.
Neches R.
Colorado R.
Guadalupe R.
San Antonio R.
Nueces R.
Counties with points
< 50 points
≥ 50 points
Project Area
Within project area, individual sites with points

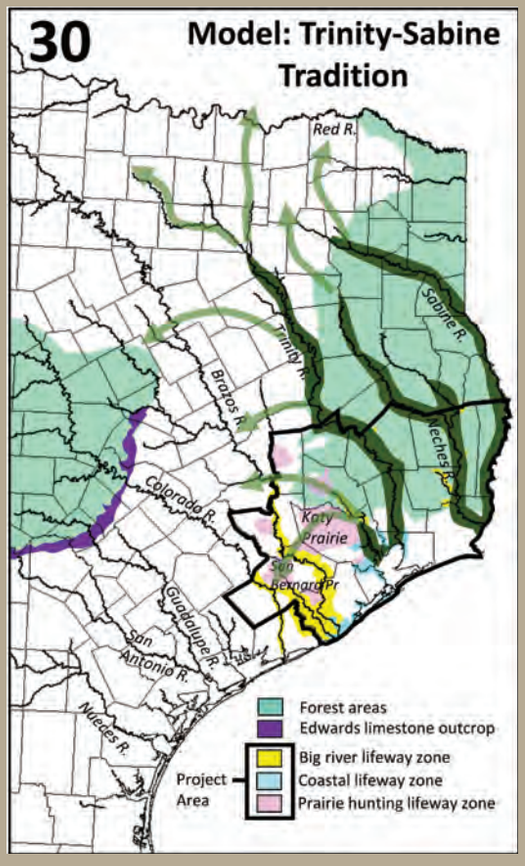

25
Gary
Red R.
Sabine R.
Trinity R.
Brazos R.
Neches R.
Colorado R.
Guadalupe R.
San Antonio R.
Nueces R.
Counties with points
< 50 points
≥ 50 points
Project Area
Within project area, individual sites with points


26
Kent
Red R.
Sabine R.
Trinity R.
Brazos R.
Neches R.
Colorado R.
Guadalupe R.
San Antonio R.
Nueces R.
Counties with points
< 50 points
≥ 50 points
Project Area
Within project area, individual sites with points

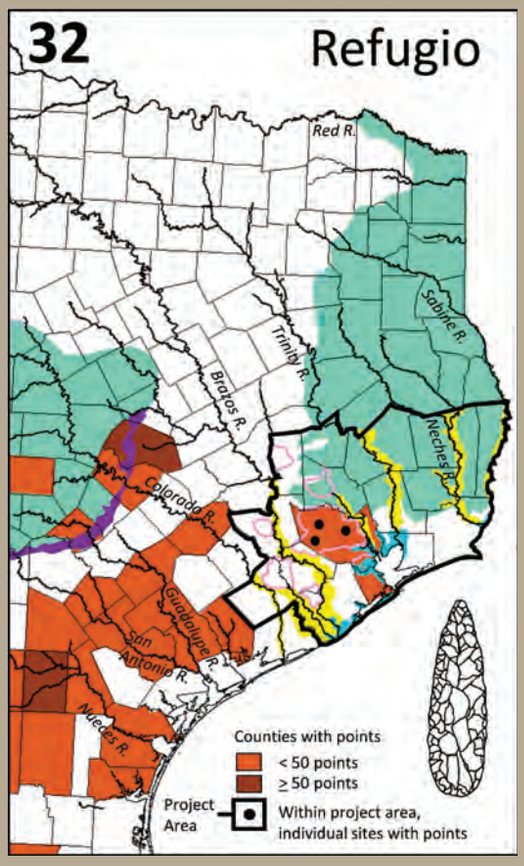

27
Yarbrough
Red R.
Sabine R.
Trinity R.
Brazos R.
Neches R.
Colorado R.
Guadalupe R.
San Antonio R.
Nueces R.
Counties with points
< 50 points
≥ 50 points
Project Area
Within project area, individual sites with points

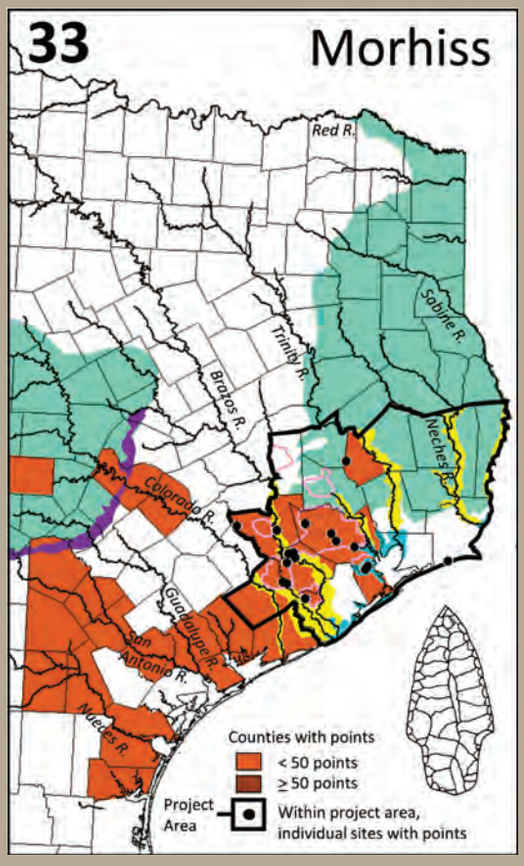

28
Catahoula
Red R.
Sabine R.
Trinity R.
Brazos R.
Neches R.
Colorado R.
Guadalupe R.
San Antonio R.
Nueces R.
Counties with points
< 50 points
≥ 50 points
Project Area
Within project area, individual sites with points

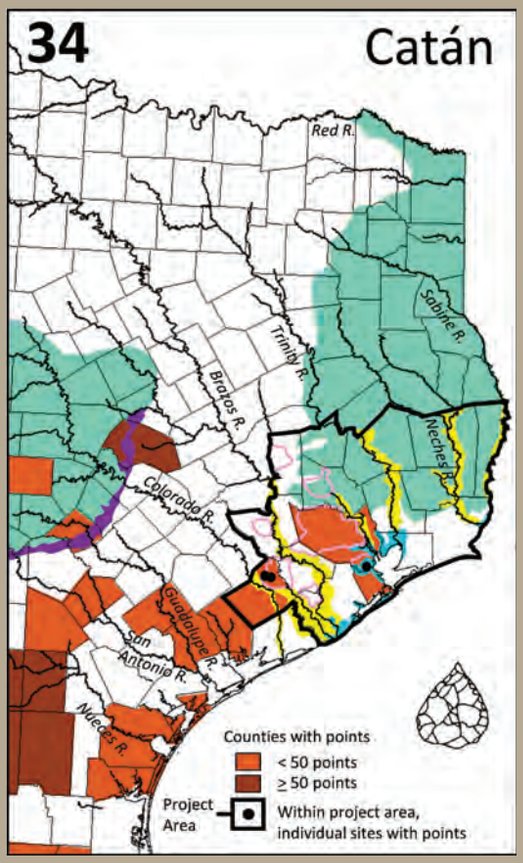

29
Alba
Red R.
Sabine R.
Trinity R.
Brazos R.
Neches R.
Colorado R.
Guadalupe R.
San Antonio R.
Nueces R.
Counties with points
< 50 points
≥ 50 points
Project Area
Within project area, individual sites with points

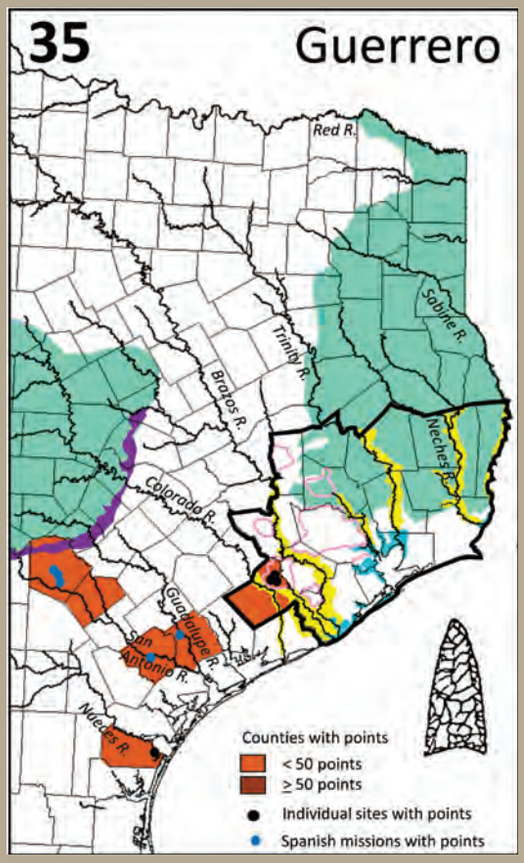

30
Model: Trinity-Sabine Tradition
Red R.
Sabine R.
Trinity R.
Brazos R.
Neches R.
Colorado R.
Katy Prairie
San Bernard Pr
Guadalupe R.
San Antonio R.
Nueces R.
Forest areas
Edwards limestone outcrop
Big river lifeway zone
Coastal lifeway zone
Prairie hunting lifeway zone
Project Area

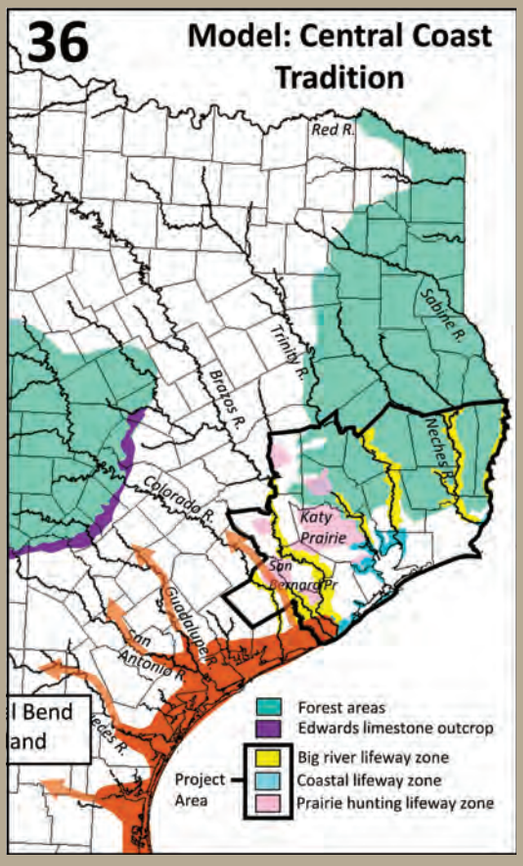
# Central Coast-South TexasTradition



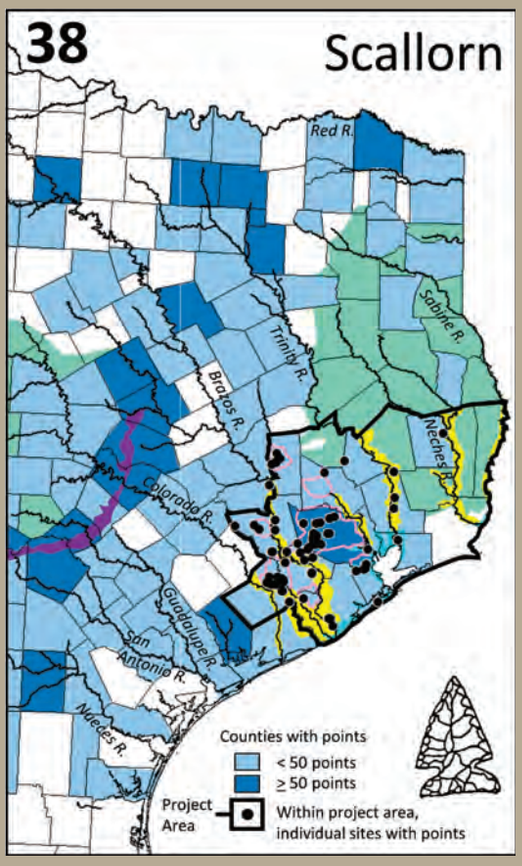



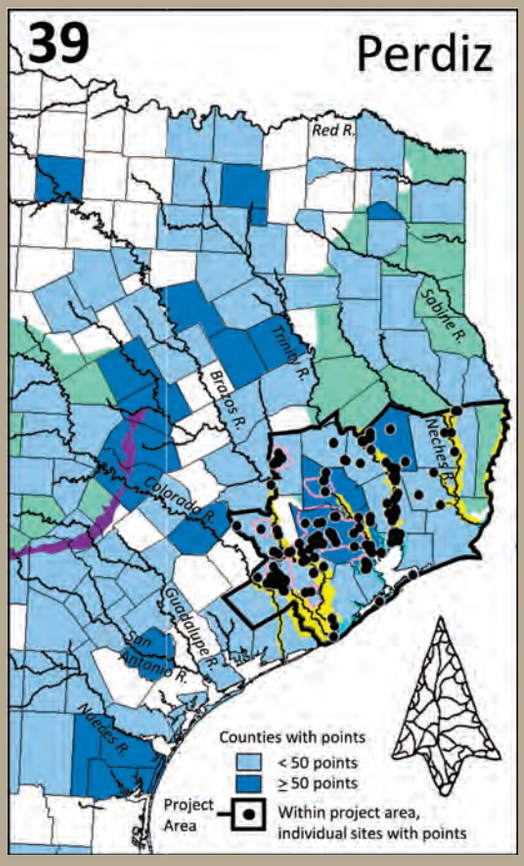

34
Catán
Red R.
Sabine R.
Trinity R.
Brazos R.
Neches R.
Colorado R.
Guadalupe R.
San Antonio R.
Nueces R.
Counties with points
< 50 points
≥ 50 points
Project Area
Within project area, individual sites with points


35
Guerrero
Red R.
Sabine R.
Trinity R.
Brazos R.
Neches R.
Colorado R.
Guadalupe R.
San Antonio R.
Nueces R.
Counties with points
< 50 points
≥ 50 points
Individual sites with points
Spanish missions with points

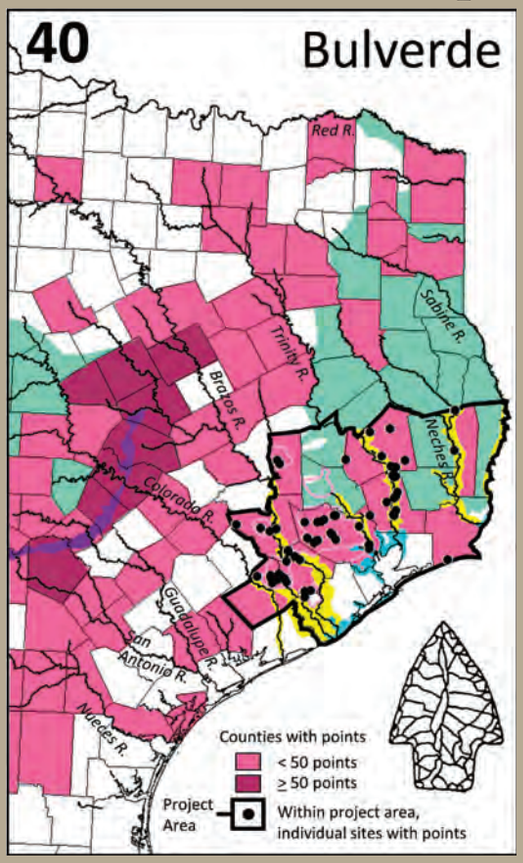

36
Model: Central Coast Tradition
Red R.
Sabine R.
Trinity R.
Brazos R.
Neches R.
Colorado R.
Katy Prairie
San Bernard Pr
Guadalupe R.
San Antonio R.
Nueces R.
Forest areas
Edwards limestone outcrop
Big river lifeway zone
Coastal lifeway zone
Prairie hunting lifeway zone
Project Area

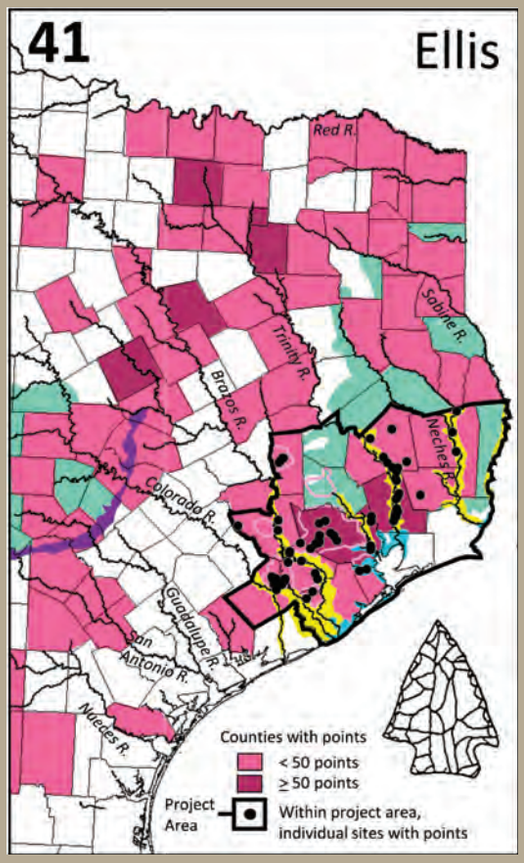
# Points with expansive distributions

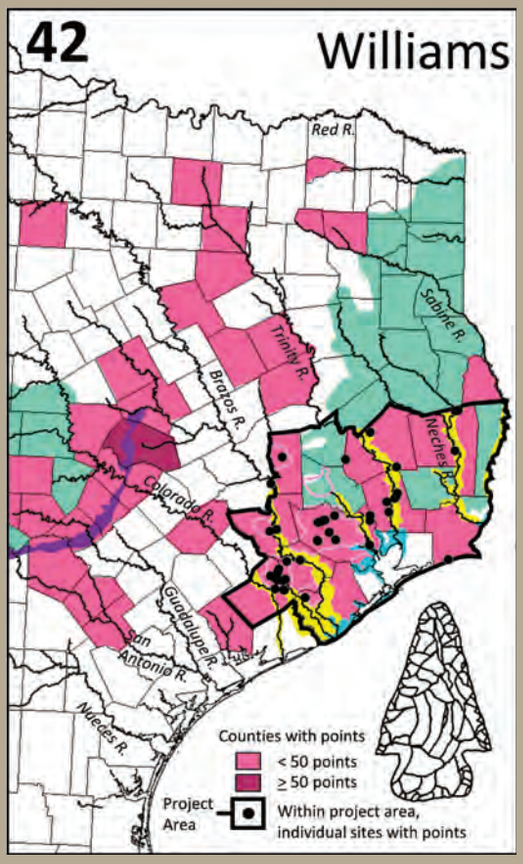


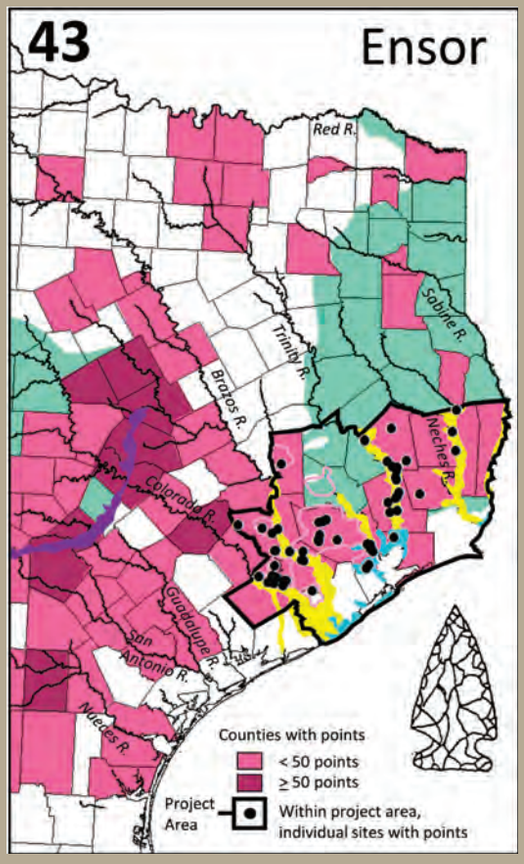



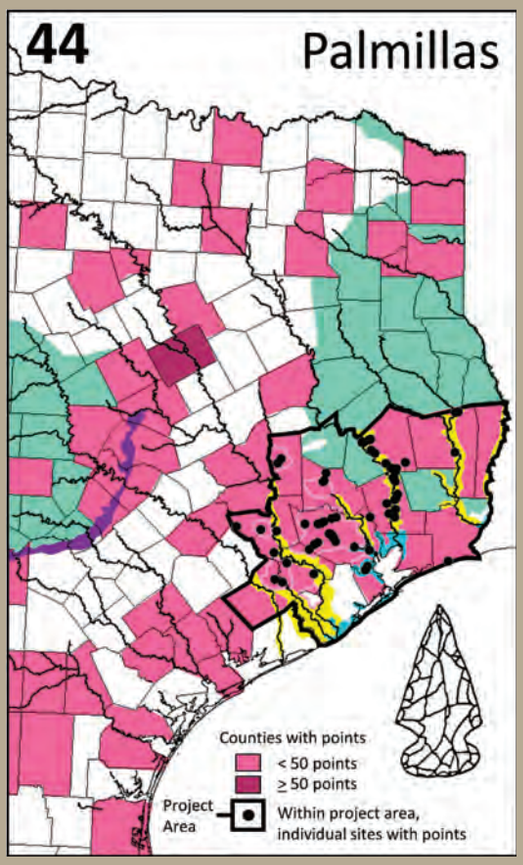
# Points of uncertain or problematic classification

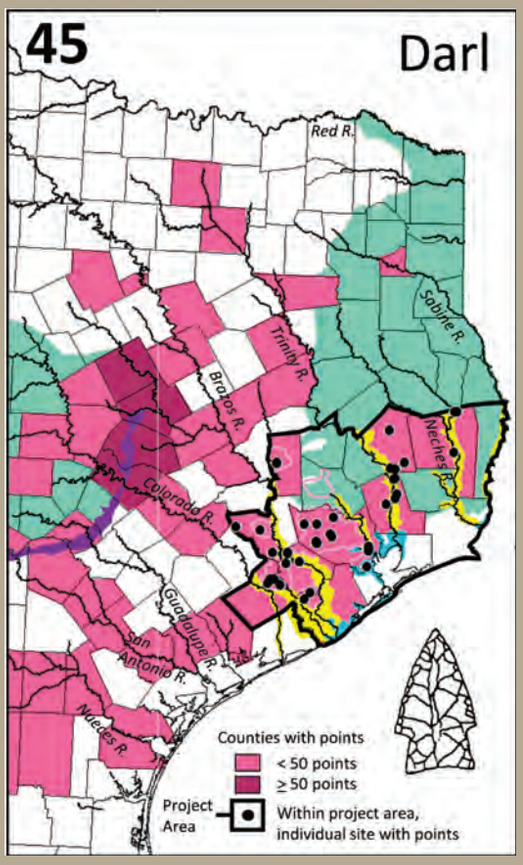


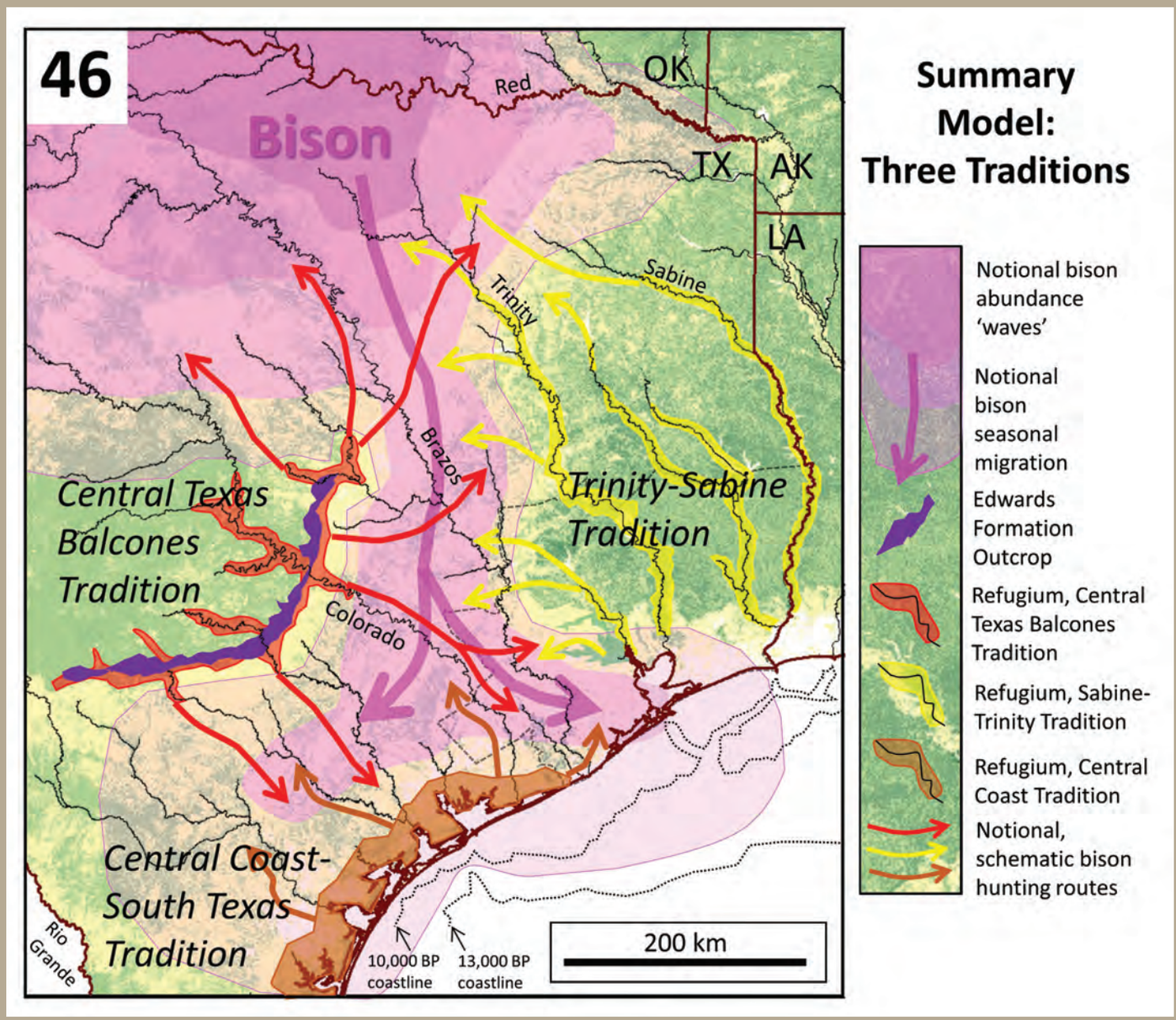




44
Palmillas
Counties with points
< 50 points
≥ 50 points
Project Area
Within project area, individual sites with points


45
Darl
Red R.
Sabine R.
Trinity R.
Brazos R.
Neches R.
Colorado R.
Guadalupe R.
San Antonio R.
Nueces R.
Counties with points
< 50 points
≥ 50 points
Project Area
Within project area, individual site with points


46
Bison
Red
OK
TX
AK
LA
Sabine
Trinity
Brazos
Colorado
Central Texas Balcones Tradition
Trinity-Sabine Tradition
Central Coast-South Texas Tradition
Rio Grande
10,000 BP coastline
13,000 BP coastline
200 km
Summary Model: Three Traditions
Notional bison abundance 'waves'
Notional bison seasonal migration
Edwards Formation Outcrop
Refugium, Central Texas Balcones Tradition
Refugium, Sabine-Trinity Tradition
Refugium, Central Coast Tradition
Notional, schematic bison hunting routes

# 8.

# Inland prairie lifeways

In this chapter the archeology and ethnohistory of two inland prairies of the Southeast Texas project area are analyzed: the Katy and San Bernard prairies. They comprise the largest part of the "inland prairie hunting" lifeway that is shaded in pink in Figure 8.1. A number of prairie sites in this zone show evidence, in the form of recovered bone, of the past hunting of bison, or deer, or both. From projectile point summaries of the previous chapter it can be shown that hunters of the Great Plains Tradition frequented these prairies in the Paleoindian Period, as did visitors from the Central Texas Balcones, Trinity-Sabine, and Central Coast-South Texas traditions in Archaic and younger periods. The nearby similar, smaller Grimes and Clear Lake prairies are treated here only in passing, but their lifeways were nearly identical (the Clear Lake Prairie, although coastal today, was inland until the Middle to Late Archaic, as was demonstrated in Chapter 2).

## Physical setting

The physical and archeological settings of the Katy and San Bernard segments of the prairie lifeway zone are shown in Figure 8.2 (see Figure 8.1 for location). The forested areas shown in this map were compiled from pre-development topographic and historical maps, as discussed in Chapter 3. The forested pattern that existed prior to European settlement has since been blurred in most of Buffalo and White Oak bayous by dense urban development. In like manner, the forests of the Brazos

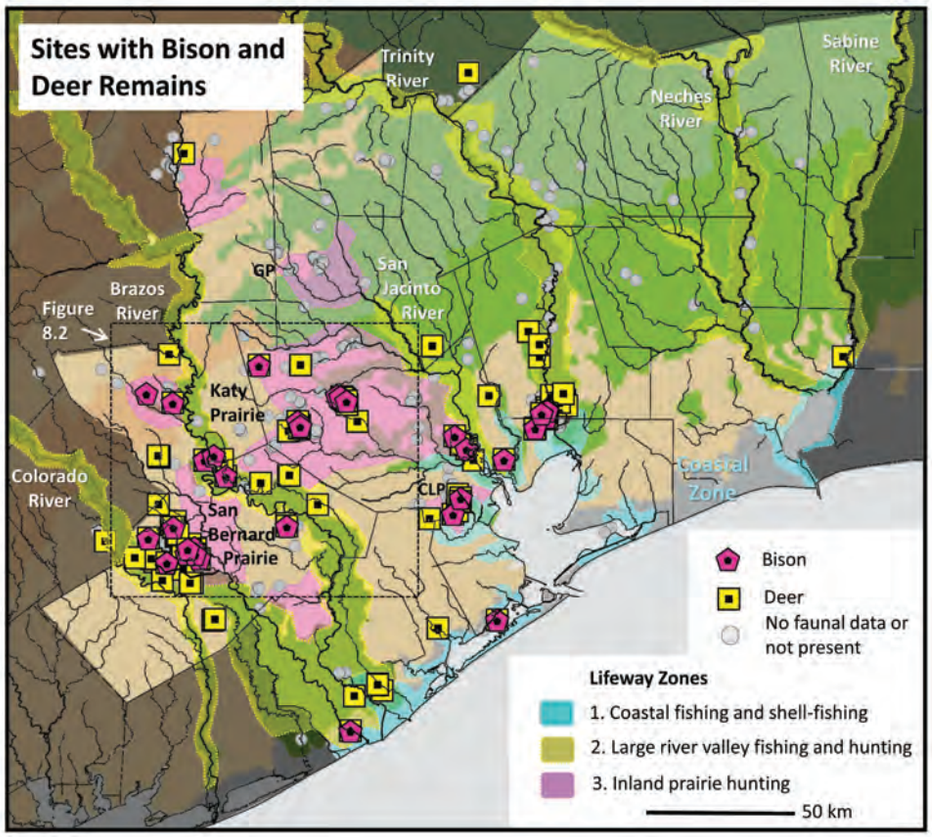



Figure 8.1. Index map showing location of Figure 8.2, as well as archeological sites with bison and deer remains. Also shown the areas of the three lifeway zones. The shaded underlay depicts ecoregions, as defined on Figure 3.7.

and Colorado floodplain valleys were largely cleared for cotton propagation. Much of the Colorado floodplain, and parts of the Brazos floodplain, remain as open cropland today.

The Katy Prairie, as defined for the purposes of this study, originally stretched northwest from the edge of a Post Oak Savannah near Hempstead to the center of present day downtown Houston. A contiguous, similar prairie stretched from that place on Buffalo Bayou all the way to Galveston Bay (including the Clear Lake Prairie), but those coastal areas are left out of the present discussion. The Katy Prairie is hemmed in between the East Texas pine forest to the north and the wide floodplain forest of the Brazos River to the south. Most of the eastern two-thirds of the Katy Prairie is now covered by urban and suburban Houston. The Katy Prairie Conservancy is working to preserve parts of what is left from urban development.

The San Bernard Prairie stretches from the same Post Oak Savannah, near Sealy, to the intersection of the Brazos River with the smaller San Bernard River, just off the southeast edge of the map. The San Bernard lies between the forested floodplains of the Colorado and Brazos rivers. The overall inland prairie landscape was thus comprised of two open corridors that stretched northwest to southeast, connecting the inland rolling plains of Texas (prairie and savannah habitat) with the saltgrass prairie and marshes of the coast.

The two prairies are essentially flat, except for Orchard Dome in the San Bernard Prairie, which is underlain by a salt dome and rises a few tens of feet above the plain (Figure 8.2). The prairies stand higher than the river valley floodplains of the adjacent Brazos and Colorado rivers. In addition, many of the smaller streams that transect the Katy and San Bernard prairies were also incised in Pleistocene

time, and have locally abrupt steeply walled drops from the flat prairie level into the stream beds. For example, White Oak Bayou, prior to its deepening by flood control engineers, had an abrupt 15- to 20-foot drop that was known to early bison hunters, as discussed later.

Known archeological sites in these prairies are marked on Figure 8.2 with small red dots. Setting aside for the moment the sites on the rim of the Brazos River floodplain, most of which are Late Archaic mortuary (cemetery) sites that are discussed in Chapter 11, nearly all the remaining archeological sites line small wooded streams. In the Katy Prairie these include Cypress Creek, White Oak Bayou, and the western tributaries of upper Buffalo Bayou; in the San Bernard Prairie they include Peach Creek, West Bernard Creek, and the small San Bernard River. One can notice that the parts of those same streams that extend northwest into the prairie and are unwooded generally lack archeological sites. Clearly, the streams needed to have riparian margins in order to be useful for the Native Americans' purpose.

## Previous archeological work

The first archeological site study in the inland area was conducted in the 1940s by Joe Ben Wheat, who was working for the Smithsonian Institution's River Basin Surveys in the upper Buffalo Bayou drainage basin of the Katy Prairie. He found evidence of Native American residency that stretched back to the time of Clovis material culture, and he first defined the major periods of the area's occupation. The inland prairie zone was not substantially discussed by Aten (1983) in his seminal work on

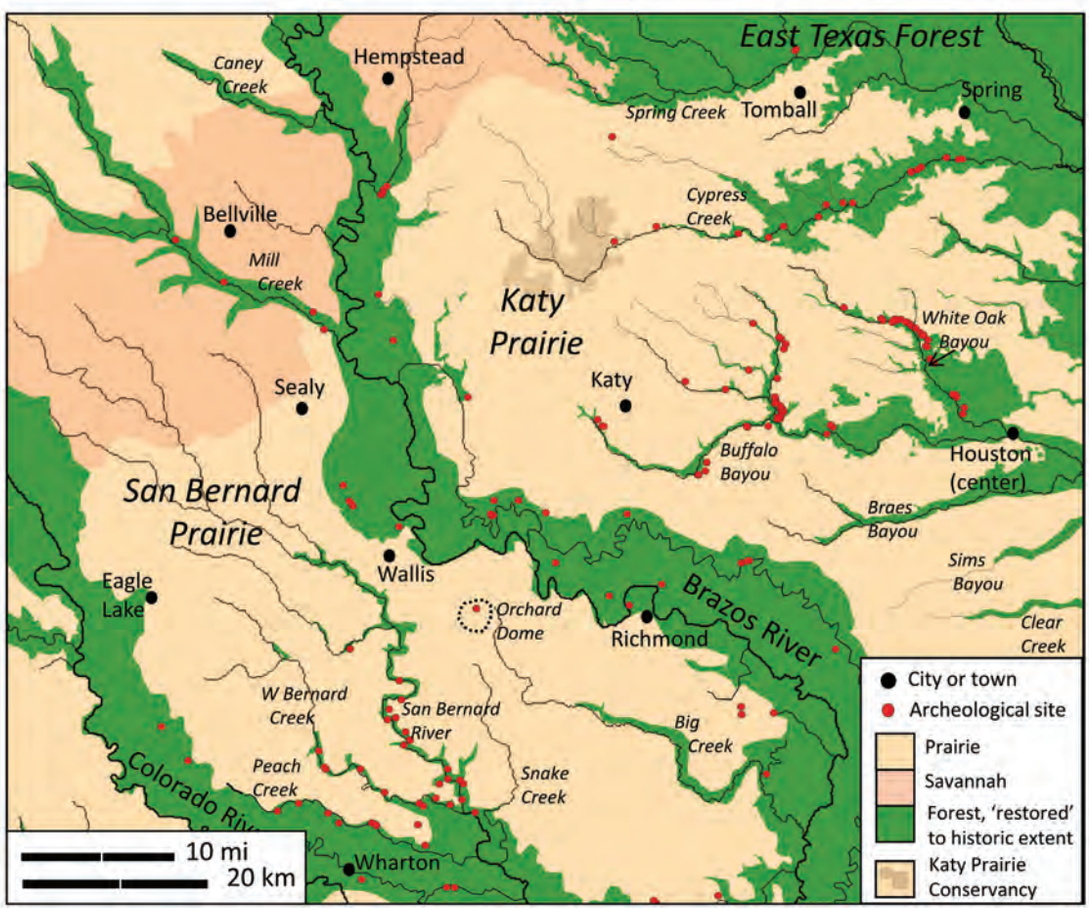



Figure 8.2. Regional vegetation map of the Katy and San Bernard prairies, restored to pre-European status (see Chapter 3), with locations of archeological sites (small red dots). Location of map shown on Figure 8.1.

the area, as his studies were principally along the coast and the Trinity River delta in the 1960s and 1970s, and at that time there were few existing studies in the two prairies. In like manner, Story (1990) focused her work farther to the northeast, and did not discuss this small prairie area that lay at the southwestern periphery of the eastern Texas forest. In the 1970s through 2000s the Houston Archeology Society directed a remarkable number of excavations in the Katy and San Bernard prairies that spread out from Wheat's work and established the major areas and lifeways of the prairie zone. In particular, the studies of Joe Hudgins and Leland Patterson laid much of the groundwork for the interpretation presented here. However, Patterson's 1996 synthesis of Southeast Texas considered landscape elements only in passing, and the prairie sites were not shown in the context of regional maps depicting their connection to the larger eastern Texas setting. Finally, several detailed site studies done by professional archeologists have been very influential, especially a study at Alabonson Road by Ensor and Carlson (1991) and an excavation at the Witte and other sites on the Brazos River by Hall (1981).

## Ethnohistorical accounts of hunting in the Katy and San Bernard prairies

A number of Spanish and French accounts describe the hunting of both bison and deer on the Katy and San Bernard prairies in the early Historic Period. Such accounts are useful in helping us understand the context of bison and deer remains found at archeological sites in those prairies. As shown in Figure 8.1, bison remains in Southeast Texas are found principally in those two prairies and along the northwest coast of Galveston Bay.

### An Akokisa bison hunt on the Katy Prairie

As was mentioned above, the French castaway Simars de Bellisle's account of his time living with a band of Akokisa in the northern part of Galveston Bay in 1719–1721 (Chapter 4) includes an account of a Native American bison hunt in the Texas coastal region, and a more detailed version of it follows. It was an early winter communal bison hunt, for which the usually coastal Akokisa migrated temporarily inland. The Akokisa band he was with had four horses; everyone else, including de Bellisle, would walk.

Figure 8.3. *Indian Buffalo Hun*t on the Great Plains, by Charles Wimar, 1856.

> *When the beginning of winter came* [1720], *we all left to join a band of their people who were waiting for us at the end of the bay. . . . After a few days had passed, they told me that all the men were going to hunt buffaloes and were going to war against their enemies and that I should keep myself ready to go with them the next day and that I should carry part of their baggage on my back. We left then and they go very fast because they have good horses, and I had to keep up, naked as I was. . . .*
>
> *I walked for two days under such condition, and the third day we arrived at a prairie that seemed endless in every direction and where numerous buffaloes were grazing.* (de Bellisle, in Folmer 1940)

The site was in all likelihood the Katy Prairie; a probable route is sketched on Figure 4.10, Item 8. In another part of the narrative de Bellisle described the prairie that he had traversed to get to the hunting site:

> *On the morning we left to go on the buffalo hunt . . . we came across beautiful prairie, and I saw similar ones for a distance of forty to forty-five leagues. This is the most beautiful country in the world. The earth is almost black. Grass grows there to a prodigal height, and in abundance. . . . .*
>
> *We halted there to hunt. They gave their horses a rest for the remainder of the day, and the next morning they mounted their horses, taking their arrows. They discovered a herd of eighty or a hundred buffaloes. They caught up with them very quickly with their horses, and when they were opposite them, they shot them with their arrows very skillfully, without halting. That morning they killed fifteen or sixteen buffaloes. We ate as much as we wanted because we had not eaten for two days.*

The manner of hunting while mounted on horseback was very new, as the horses had come into this area from the Spanish, probably less than a generation earlier. It is this type of "modern" hunting that is shown in most depictions made by European and american visitors, such as the one shown in an 1835 guidebook for Texas immigrants (Figure 8.3).

At this point in de Bellisle's narrative, they encounter a foreign group on the prairie, hunting in an older way, with prairie fire:

> *When this expedition was finished, we saw smoke at a distance of about a league and a half. One of them asked me what it was. I told him that it was a fire on the prairie. He asked me if there were people. I answered him that someone ought to be there and that no deer had lighted that fire. They said that eight of their band would go there to kill the people and that they were their enemies. They left to go towards this smoke, where they found ten or twelve Toyals. That is the name of their enemies.*

Hodge (1907) and others thought the scribe who produced the dictated de Bellisle manuscript misspelled what should have been Tojal, and that these were members of the Tohaha, whom Spanish and French observers placed along the Colorado River in the early eighteenth century. The Tohaha are generally considered to have been of Tonkawan affinity (Campbell 2020). The Tonkawa are thought to have arrived in Central Texas as late as the eighteenth century from the high plains and merged with several small local existing groups there (Carlisle 2010). Swanton (1952) placed the Tonkawa in both Cen-

tral Texas and the plains to its east. They appear to have been the most recent heirs to the Central Texas Balcones Tradition. Returning to the narrative,

> *Nevertheless, they were able to kill but one. . . . With their arrows they made him come down much more quickly than he had climbed up. When this man was dead, they loaded him up on their horses and brought him to the place where we had stayed to wait for them. One of them cut his head off and another cut the arms off, while they skinned him at the same time. Several of them ate the yellow fat, which was still raw, and finally they devoured him completely.* (de Bellisle, in Folmer 1940)

Atakapan Akokisa, like the Karankawa, Tonkawa, and several other Texas tribes were known to consume their fallen enemies, apparently in the belief that so doing allowed them to obtain the dead person's bravery (Weddle 1985; see discussion, Chapter 4).

From this hunting trip of 1720 we learn that for the coastal Akokisa, (1) bison hunting was a communal hunting event that took place in early winter, (2) they had done it before, and (3) they knew beforehand to expect competition. Through de Bellisle's account, we witness members of the Trinity-Sabine and Central Texas Balcones traditions hunting in the same Katy Prairie, and we learn that they did so as enemies, not collaborators. This knowledge can shape perceptions of what is involved in the mixing of point styles from different traditions in the Katy Prairie archeological sites discussed later. Finally, there is the juxtaposition of modern hunting methods of the time, on horseback, versus the older use of prairie fire by a presumed horseless group of Toyals.

### Seasonal migration of bison

In February 1746 the Spaniard Orobio Basterra came upon two Akokisa villages of temporary, skin-covered shelters in the Katy Prairie, and another such village inhabited by Bidai Indians in the Grimes Prairie just to the north of the Katy Prairie (Figure 4.10, locations 15 and 16). Bidai Chief Tomás, at that winter village site on Grimes Prairie, lived along the Trinity River in warmer weather, as other Spanish era documents show. In 1772, somewhere near one of those by then abandoned villages in the northwest Katy Prairie, Don Luis Cazorla came across a large group of coastal Karankawa, Coco, Bidai, and Jaranames Indians assembled in the Katy Prairie for an early fall deer hunt. The mostly coastal people in this large group were involved in communal hunting for deer, to obtain pelts to sell to the French.

In nearby coastal southwest Louisiana in 1781, as was mentioned in Chapter 4, Louis LeClerc Milfort came upon a lone Frenchman who had been living with the Atakapa. This man related that he and his Atakapa band were leaving to head north "in order to follow the buffalo, which in the spring go back into the west, and in autumn come down into these parts" (Milfort 1802). These bison were likely migrating to the Tertiary Uplands prairies in northern Louisiana that locally surround the central Mississippi River Valley. Le Page de Pratz (1763) observed Indians in the Lower Mississippi Valley seasonally pursuing bison as follows: "They hunt this animal in the winter; for which purpose they leave Lower Louisiana, and the river Mississippi, as he cannot penetrate thither on account of the thickness of

the woods" (de Pratz 1763). David Woodman's 1835 guide for Texas immigrants mentions the same seasonal migration of bison: "the buffalo, or the bison, known in this country as the bonassus, . . . enters Texas from the north in vast herds in the winter" (Woodman 1835). It is likely that the Akokisa and Bidai were gathered in their temporary winter shelters in the northwest Katy Prairie for just such a seasonal migration event.

The *seasonal* migration of bison—as opposed to the longer-term, climatically caused pulses of bison migrating into Texas from the southern Great Plains—has been a matter of some controversy. European and American observers from the seventeenth through the nineteenth century believed that bison on the Great Plains migrated large distances with the seasons (Speth 2017). Although some thought that bison herds might actually roam annually from Canada to Texas (e.g., Allen 1876), most considered seasonal migration to occur along much shorter routes. Seton (1910) studied the issue with historical documents collected by W. T. Hornaday (1889) and summed up his view: "I conclude with Hornaday that the buffalo did migrate 300 to 400 miles northward in the spring, and as far southward again in the autumn." R. I. Dodge, who observed migrating bison first-hand, noted in the central Great Plains that "towards fall, when the grass of the higher prairie becomes parched by the heat and drought, they gradually work their way back to the south, concentrating on the rich pastures of Texas and the Indian Territory, whence, the same instinct acting on all, they are ready to start together on the northward march as soon as spring starts the grass" (quoted in Seton 1910).

Archeologists and western historians in recent decades tended to question these first-hand accounts. Roe (1970) concluded that they were stories based on analogies to cattle drives. Hart (2001) studied similar records and concluded that bison did not substantially move from one locale, and that their movements were unpredictable. These academic studies, of course, came well after the near-extinction of bison.

More recently, Bruggeman and others (2009) have shown that bison in the area around Yellowstone National Park have a seasonal migration from high country to low country. But did bison in prehistory migrate in such a manner? It is a question of some significance, because if bison moved in a repeatable cycle, then early Native Americans could have used that information to drive and trap them. Recently Graves (2010) and Carlson (2015) used trace element analysis of bison teeth from the kill sites of the Beaver River Complex of northwestern Oklahoma to pursue this question. Layered enamel in excavated teeth from Folsom-age sites allowed the researchers to identify specific places in the landscape that the animals had visited in an annual cycle. With this information, they reconstructed an annual, repeatable cycle in which bison grazed in the Llano Estacado of the Texas Panhandle in the summer, returning to the Rolling Hills of central Oklahoma in the fall, where they wintered—a distance of about 600 km, matching the estimates of the nineteenth-century first-hand observers mentioned.

If we take the ethnohistoric accounts at face value, bison were seasonally migrating into the Katy and San Bernard prairies of Southeast Texas during the early Historic period. The bison were headed still farther coastward, where lush coastal grasses awaited during the cold months. The map of Figure 7.2 notionally depicts their southward travels. It represents areas of modern forests in green, taken from

satellite data modified by the U.S. Forest Service (Wilson et al. 2013). The large forested areas of the East Texas Pineywoods and the Edwards Plateau are obvious. The prairie and savannah of the remaining areas of north-central and southern Texas have a yellow tinge with local spotty distribution of trees; many of these are post-colonial mesquite, which has partially forested large swaths of former grassland, and others are copses of oak in savannah belts. The Forest Service map has been modified here for areas in which riparian forests along the Brazos and Colorado rivers were removed during Anglo settlement. Green shading has been added to those areas. A small area around Buffalo Bayou and Cypress Creek has likewise been shaded, as urbanization there has masked the forest in the satellite map. The prairie lifeway zone, highlighted in dotted pink lines, is as displayed on Figure 8.1.

As the map of Figure 7.1 shows, the prairies between the Brazos and Colorado form a natural grassland corridor that narrows in width to the south, at the San Bernard prairie. The prairie between the Eastern Texas Forest and the Brazos River can likewise be thought of as a corridor that narrows down in the south, to the Katy Prairie. Bison migrating southward would have had to pass through these two prairie corridors to be able to reach the coast, and the Native Americans seem to have known this, and they lay in wait for the animals during the fall and winter.

What drove the bison south every year? For the past quarter century, I have lived on a farm on the southern edge of the Katy Prairie near Fulshear, Texas, where we have kept a small herd of cattle. The grass is lush in a good year. In the fall, "blue northers" start their advance across the Texas plains, and the freeze line crosses into northern Texas. A few weeks later, the next norther brings the freeze line a few counties farther south, and so on. Eventually, by about late October or early November, the first norther strong enough to cause our first frost arrives at our farm. Grass that was tall and green the day before immediately turns brown and loses much of its nutrient value. The fenced-in cattle soon have no food and must be fed hay to supplement any winter forage. During the same time, however, prairies in coastal parts of Galveston and Matagorda counties are typically still green, and indeed may remain so for much of the winter. Bison that reached the coast would spread out to enjoy the coastal grasses there, as evidenced by the plotting of bison remains at archeological sites in Figure 8.1, and as noted by Joutel in the 1680s near Matagorda Bay (Chapter 4).

### Prairie setting and arrangement of archeological sites

We know from the abovementioned studies in Oklahoma and other Folsom-age kill sites that by the Early Paleoindian Period hunters understood annual bison migration, and hence could predict when and where bison might arrive, at least in terms of the seasonal migration. It is reasonable to assume they also knew that the herds in the fall and early winter were likely to be composed of cows and calves and would tend to stay in a group. And they knew that bison preferred to stay out in the open, wherever possible eschewing forested zones like the riparian woodland lining rivers and streams.

From the arrangement of archeological sites in the Katy and San Bernard prairies, these hunters also knew that before migrating bison could reach the coast, they

had to go through the eye of the needle, where the prairie corridors connecting the inland plains with the coastal salt marshes necked down. Of particular interest in the regional setting of these two "bottleneck" prairie corridors is the pattern of small prairie streams that branch into many stream forks, all opening to the northwest, creating numerous tree-lined funnels opening northwestward that nearly span the width of each corridor (Figure 8.4). From the notional perspective of entering bison, presumably travelling southeast on a seasonal migration, this pattern sets up something like a pinball machine in each corridor, with many tree-lined, funnel-shaped cul-de-sacs where bison might be driven into stream beds, as highlighted by the pink arrows. As mentioned above, these small streams were incised into the prairie during the last period of falling sea level in the Late Pleistocene, and many of them had from one to ten meters of drop from the flat prairie surface to the stream bed. This is the setting of the many archeological sites that line the streams. The consistent pattern of branching, tree-lined streams and V-shaped cul-de-sacs that open to the northwest, lined with archeological sites, suggests a communal bison-hunting strategy in the long millennia before horses: run the bison into the incised stream channels, where either the small drop or the muddy stream would slow the animals down, and then harvest them there. It was a hunting strategy tailor-made for the landscape.

Ethnohistoric sources recount that Indians in the Great Plains and along the Texas coast used fire to coax the animals into a certain route (see discussion, Chapter 3), perhaps leading them to the end of a cul-de-sac, or forcing them to swim

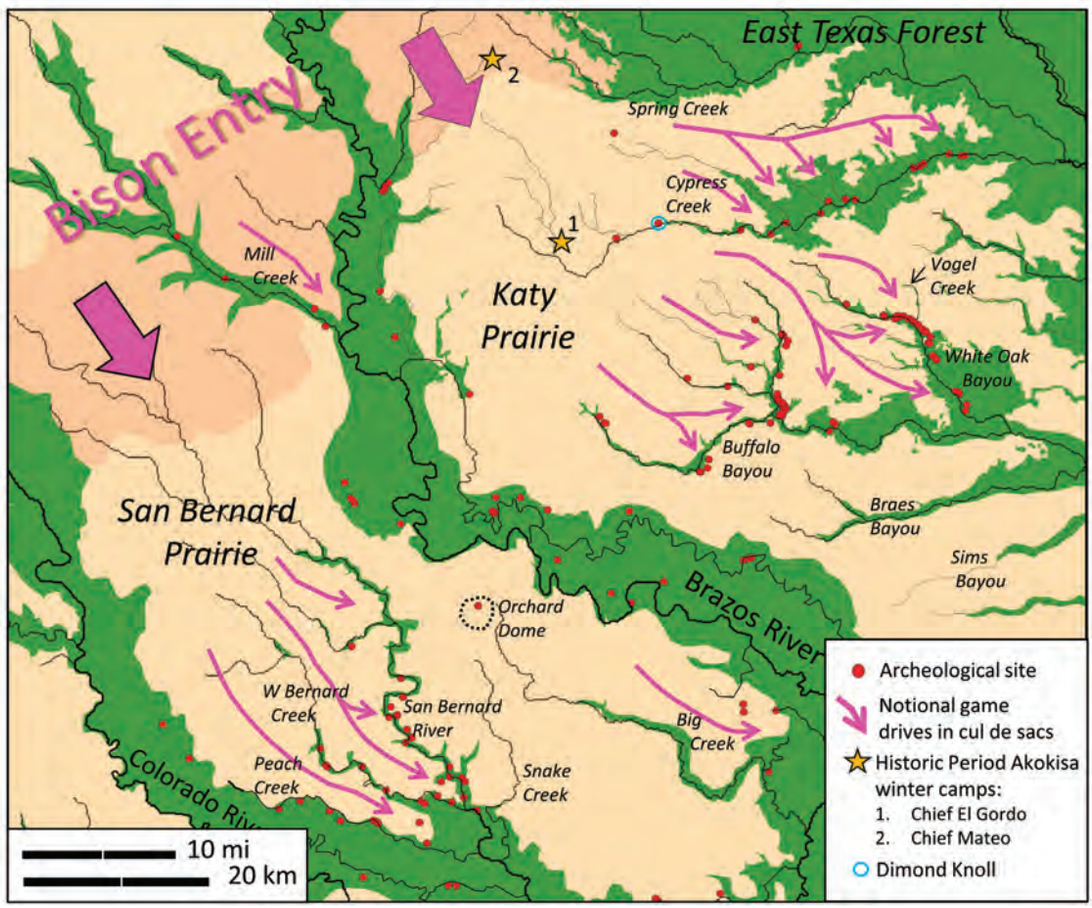
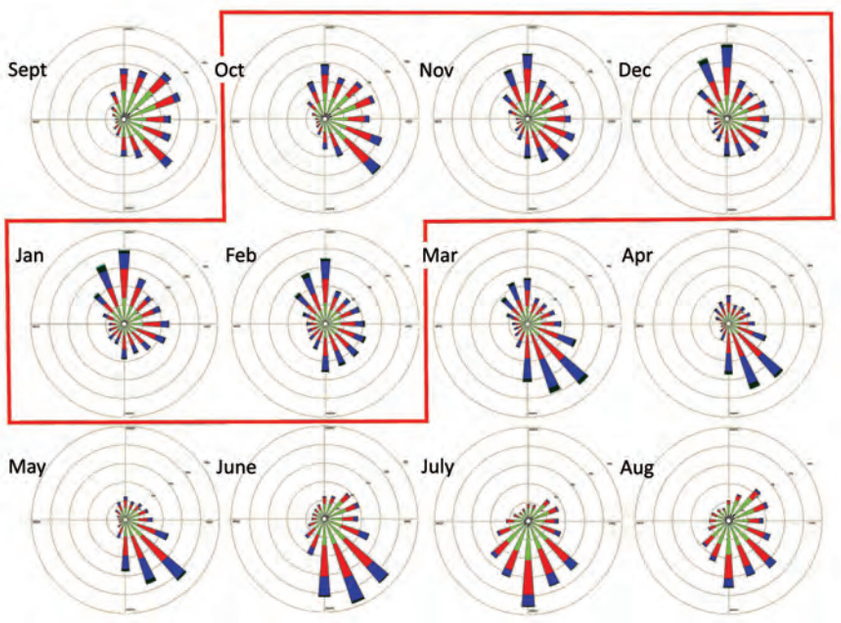



Figure 8.4. Interpreted bison migration entry and natural migration cul-de-sacs (pink arrows). The ends of these cul-de-sacs would have made ideal ambush points for early hunters. Small red dots show archeological sites, which tend to cluster around these cul-de-sacs.




across a broad creek, where they would be slowed down and would present an easier target for hunters, who before European arrival were on foot. Here the natural environment of Southeast Texas offered the hunters yet another advantage. During the same months that bison migrate into the area, there is a prevalent wind from the north-northwest. Wind rose diagrams from the Houston Intercontinental Airport reveal that during the months October through February, wind directions show the effects of the predictable and regular winter "northers." As Figure 8.5 shows, this prevailing wind direction is almost parallel to the directions of potential drive lines heading to the cul-de-sacs. This seems likely to be the reason that the Toyals who were fiercely pursued by de Bellisle's Akokisa companions were setting fire to the prairie in the winter of 1720, and why Joutel witnessed a prairie fire followed by Karankawa in pursuit of deer. Native Americans could take advantage of the prevailing winter winds from the north-northwest by starting prairie fires that would move to the south-southeast, bringing bison or deer into cul-de-sacs and adjacent stream beds, where hunters presumably waited to harvest the slowed animals.

As discussed in Chapter 3, in seventeenth-century Virginia Captain John Smith observed that Native Americans were using fire to drive deer into a large waterway,

Figure 8.6. A prairie fire, where panicked deer escape by swimming across a small creek. Drawing by Julian Rix from *Harper's Weekly*, New York, August 14, 1886.

Figure 8.5 (left). Monthly average wind directions for Houston Intercon-tinental Airport in 1961, displayed as wind rose diagrams, from the National Water and Climate Center, U.S. Department of Agriculture. Diagrams show directions of origin for winds; length represents relative percentage of time that wind blows from a particular direction. Red box highlights time period from late October through February, when "northers" (cold fronts) sweep across the prairie and north to northwesterly winds are prevalent.

Figure 8.7 (right). Bison fleeing a prairie fire in the Great Plains, 1830s, in a painting by George Catlin entitled *Prairie Meadows Burning*, ca. 1861–1869. Courtesy of the National Gallery of Art, Washington.

where waiting hunters in canoes killed them. An 1889 illustration of a prairie fire (Figure 8.6) shows deer escaping a fire by flinging themselves into a stream. The stream would slow their advance, allowing hunters to hit them more easily with projectiles thrown with atlatls or, later, with arrows from bows. George Catlin, the frontier artist who visited the Great Plains in the 1830s, witnessed the effects of Indian-started prairie fire on bison. The animals fled in panic and could easily be driven off a low cliff, there to be picked off (Figure 8.7).

It is difficult to demonstrate conclusively that fire was used for such purposes in prehistory, or to calculate its extent precisely, even in rocky places where stone drivelines and entrapments clearly record earlier efforts to drive bison. Recently a group of researchers looked at some very young stone wall drivelines built by Native American hunters on the northern Great Plains in western Montana, on Two Medicine River on the Blackfeet Indian Reservation (Roos et al. 2018). Radiometric dates of bone beds related to bison kills near complexes of stone wall drivelines ranged from 900 to 1650 AD. Alluvial and colluvial soil layers in the area contained multiple charcoal layers (five to eight layers at each site) that were sampled and dated. They showed unusually high peaks of fire activity between 1100 and 1650 AD, which corresponded to the dates of bison bone beds at the site. The authors considered this as strong evidence for anthropogenic burning as part of bison hunting, either as a direct drive mechanism or as a way to attract bison to the driveline area by encouraging new growth of grass. The cessation of such game drives in that area correlates with the time of accession of horses by the Blackfeet tribe, suggesting that Native Americans with horses could now pursue bison directly, and were no longer constrained to specific physical sites.

Archeological evidence at several sites in the Katy and San Bernard prairies, discussed later in this chapter, favors an interpretation of driving game into stream beds, perhaps using fire. In other sites, the data are inconclusive, and it is important to consider other harvesting methods seen and recorded by early visitors to the southeastern United States. One method is that of simple surround hunting,

witnessed by Frenchman Le Page du Pratz in the late eighteenth century (du Pratz, 1763). He observed Indians of the Lower Mississippi Valley hunting groups of both bison or deer by simply surrounding them with large numbers of hunters on foot, who gradually tightened the circle and then picked off the unlucky beasts (Figure 8.8). Deer were sometimes encircled in similar manner, as shown in that figure. Such encirclement is easier in forested cul-de-sacs of the sort shown in Figure 8.4, where if the cul-de-sac was narrow enough, hunters could emerge from their forest hiding places on three sides, and rapidly close off the fourth side, trapping the animals. As discussed in Chapter 4, Cabeza de Vaca observed South Texas coastal Indians in the open prairie encircle deer with fire, burning the prairie and ever-tightening the animals' shrinking open space (Favata and Fernández 1993). And in Iowa in the late 1600s, Nicholas Perrault saw a large group of Native Americans using the same fire-surround technique on bison in the wide open prairie (Wissler 1920). Atakapa folk stories already discussed (Chapter 4) allude to animals being taken by means of fire.

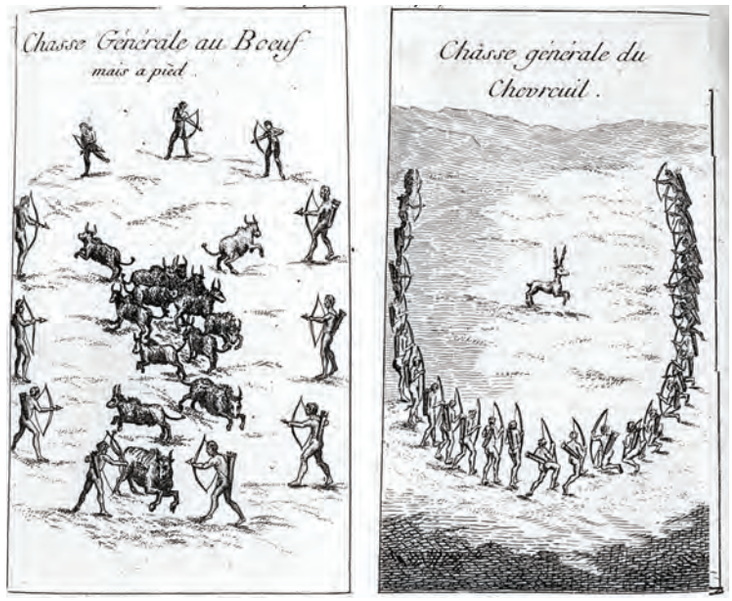



Figure 8.8. Drawings of Lower Mississippi Valley Indians hunting large animals by encirclement, late eighteenth century. Left, a bison hunt. Right, a single deer is ritu-ally hunted, as individual hunters show off their skill. Deer in small herds were reportedly hunted in this manner. From Du Pratz, 1763.

However the harvesting of bison and deer was accomplished, it was an event that occurred over and over again at these sites, for millennia. Figure 8.9 shows the locations of the same archeological sites, but colored by age of artifacts at each site, using projectile point chronology. There are many sites in this prairie area that show evidence of periodic occupation extending from Paleoindian time through the Late Prehistoric Period (and in some cases, but not shown on this map, the early Historic Period). In particular, the sites of White Oak Bayou, upper Buffalo Bayou, Cypress Creek, and the San Bernard River–Peach Creek area are lined with such "multicomponent" sites, some dating as far back as the Early Paleoindian (Clovis and Folsom) Period. This is strong evidence of an area of rich abundance of resources, but the small, shallow streams themselves have limited food resources (turtles and small mammals); the rich prize that kept hunters returning over the millennia to the same small areas was clearly the larger prairie game of bison and deer.

### Hunting deer on the open prairie

Although bison seem to attract most of the attention of historians and archeologists, data from archeological sites on the Katy and San Bernard prairies, discussed later, indicate that deer bone is the most prominent large mammal bone found in post-Clovis hunters' sites. Today deer are usually seen alone or in small groups in woodlands, or grazing safely close to a woodland, primarily due to hunting pressure. In frontier days of the early and middle nineteenth century, deer were commonly found in herds on the open prairie, sometimes grazing with antelope. For example, a traveller named John Bartlett, travelling the South Texas border as part of the

border surveying expeditions of the 1850s, described what he saw in the southern plains of Texas in January 1853:

> *Thousands of deer and antelope were scattered over it. . . . Droves of mustang also appeared. The deer and antelope were usually grazing in herds of from ten to fifty, and as we approached they leisurely trotted off to a short distance and again stopped. We shot none, for I was desirous of reaching Corpus Christi by night.* (Bartlett 1854)

Mary Helm, who with her husband founded the Texas coastal city of Matagorda in 1828, described local coastal prairies within the present project study area during early settlement days:

> *A continued and continuing variety [of prairie flowers] carpeted our way for whole days together as we traveled, with scarce a sign of a former traveler to mark the path, while large herds of deer in easy distance would stop grazing to look at us, and every way, which the eye looked countless herds were seen in the distance. . . . At no time were we without large herds of deer in sight in every direction . . . .deer being in droves of hundreds in every direction which had not yet learned to fear man, but would approach him if he would sit down to see what he looked like, and thus come within gunshot.* (Helm and Wightman 1884)

These large herds of deer, now vanished, explain what Spaniard Don Luis Cazorla found in late September 1772 on the Katy Prairie: a mixed group of Jaranames (from Corpus Christi area), Karankawa, Coco, and Bidai, assembled from great

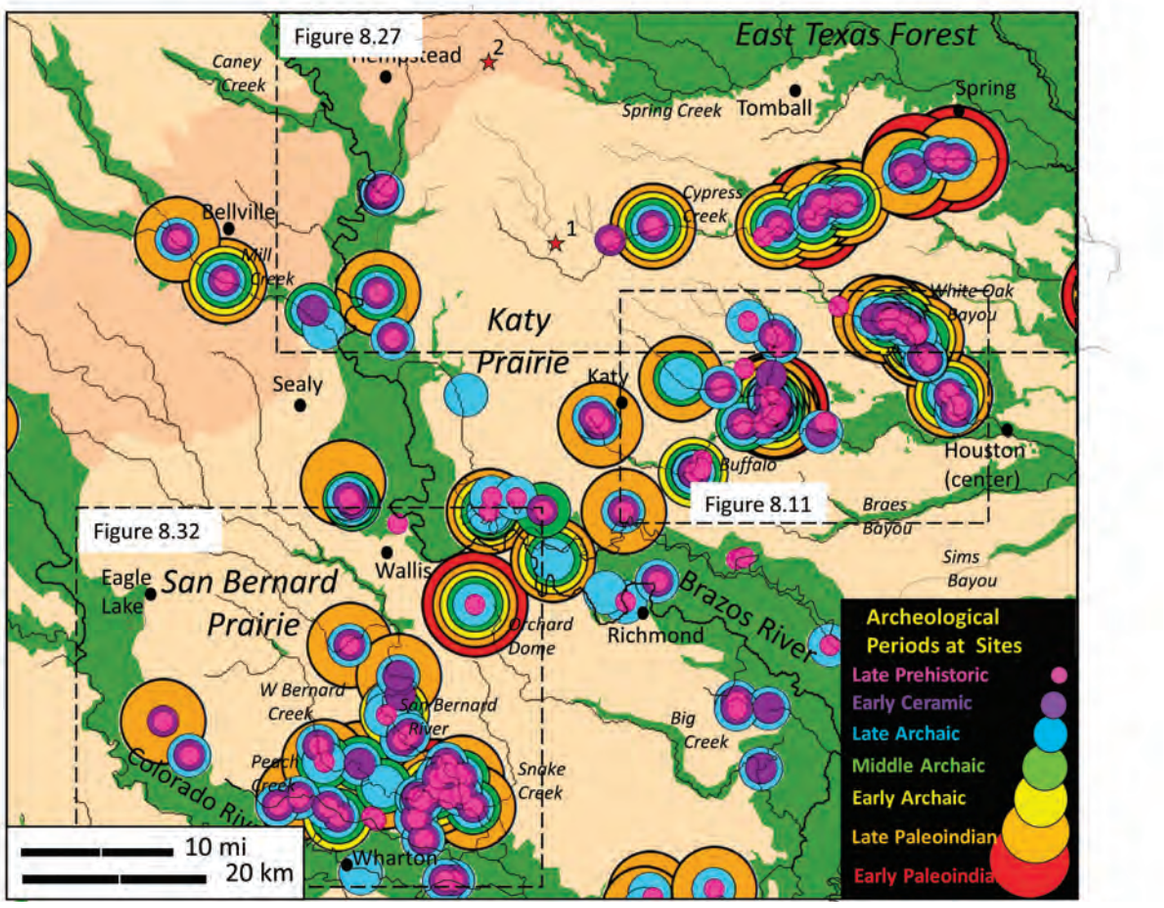



Figure 8.9. Archeological periods represented at sites, from lithic chronology. The prairie is interpreted as an area of intermittent seasonal occupation by hunting groups over long periods of time. Dashed rectangles show locations of area maps discussed in text.

distances to work together to hunt deer. They were market hunting to sell deer hides to the French (see Chapter 4), and with such a large group, they were clearly using some sort of communal hunting technique. As discussed later, archeological data from some sites in the Katy Prairie (the Alabonson Road site is one) suggest that deer were being regularly butchered offsite and separated into quarters, then brought to campsites that were some distance from kill sites. That practice could be consistent with communal hunting techniques. Certainly, individual hunters could stalk deer one by one, but it is difficult to see that practice sustaining large base camps of people, such as at the Alabonson Road site.

Unlike bison, deer do not migrate seasonally. According to biologists at Texas Parks and Wildlife Department (2019a, 2019b), who monitor statewide deer populations in order to regulate the Texas deer hunting season, deer are homebodies that rarely move more than a kilometer or so, year-round. They are most active during the rutting season, which varies in time by area, but for the northern Gulf Coast prairies, including the Katy and San Bernard prairies, it has its peak in the last half of September and the first half of October. Modern day hunters are busy during the fall, because at this time bucks tend to lose a lot of their natural caution as they seek does for mating. Unsurprisingly, coastal Native Americans apparently knew this, too. When Cazorla came upon the group of various tribes engaged in communal market hunting of deer on the Katy Prairie in 1772, it was in late September.

Figure 8.10. Buffalo Bayou west of Houston, ca. 1890. A hint of the steep encasing banks is given by the leaning tree in the foreground, underneath which the bank has been eroded by stream movement. Photo MSS0157-0073, courtesy of the Houston Metropolitan Research Center, Houston Public Library.

The non-migratory behavior of deer was likely a plus to coastal Indians like the Akokisa with whom Simars de Bellisle hunted bison. Seasonally migrating bison could be delayed by a late autumn or by other short-term weather events farther north. If for any reason the bison did not appear, there were deer to hunt, in a new area away from the group's normal coastal haunts.

So far this discussion of the prairie lifeway zone in the Katy and San Bernard prairies has been mainly based upon a helicopter view of landscape archeology plus a review of hunting practices of Native Americans gleaned from ethnohistorical information. The remainder of this chapter considers the tales told by the artifacts themselves, at various archeological sites.

## Western Buffalo Bayou archeological sites

Three clusters of archeological sites in Katy Prairie are discussed here: one along the upper tributaries of western Buffalo Bayou, another at a portion of White Oak Bayou, and a final one along eastern Cypress Creek. Each shows evidence of both bison and deer hunting, from Early Paleoindian time through the Late Prehistoric Period. We begin with the sites along western Buffalo Bayou.

In its uppermost, western reaches, Buffalo Bayou breaks up into a series of small, tree-lined tributaries that, taken together, form a cup-shaped appendage that opens to the northwest (Figure 8.2). The western part of the bayou and its tributaries bear little resemblance today to their former appearance, as they have been straightened, widened, and deepened. The earth on their banks has been shaped by bulldozers and then buried by spoil dirt from the deepened creeks, which are now little more than efficient drainage ditches. Early photographs show the bayou's natural state (Figure 8.10): a narrow, shallow stream with steep, wooded banks.

Archeological sites are found along each of these western tributaries, typically at or near the intersections of the streams. Most prominent are the cluster of sites at the intersection of Mayde Creek and Buffalo Bayou (Figure 8.11A). The sites are densely concentrated; there are 28 sites in that cluster, not all of which are well displayed in the figure. This cluster of former sites has been destroyed by extensive modern flood control work and by urban development at and near the Addicks and Barker dams, beginning in the 1940s.

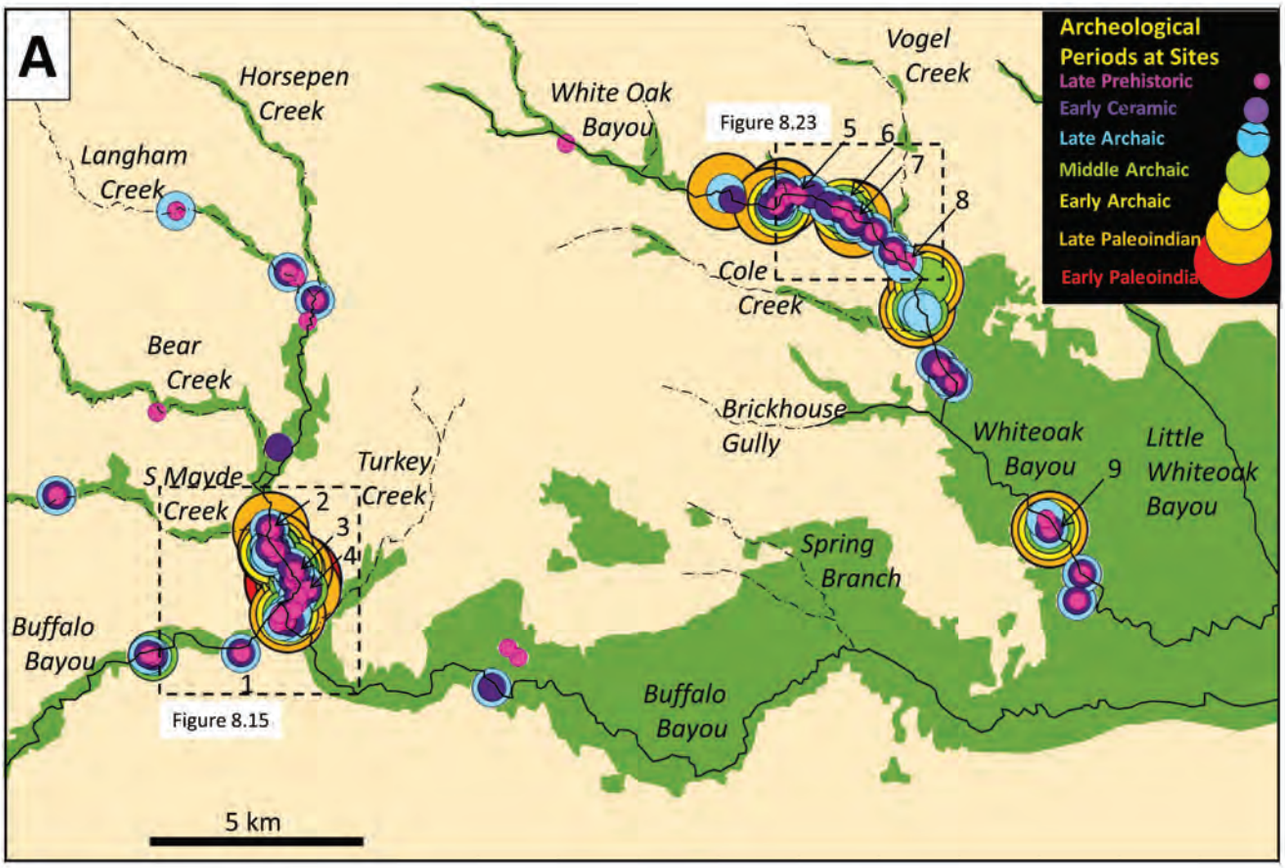
## Early studies

Study of the rich array of archeological sites here was begun by Wheat (1953), and the most prominent one is the Doering site (41HR5; Figure 8.11A, location 3). Its occupancy began at least by Early Paleoindian time, as evidenced by a single Clovis point at the lowest excavated level. Each subsequent period through the Late Prehistoric was represented in the excavated collection of dart and arrow points. The site was reasonably well stratified (although bioturbated in places by burrowing rodents), within a raised soil midden 1.2 m (3.93 ft) thick.

The Doering site contained a wide variety of lithic tools, including scrapers, choppers, drills, gravers, banner stones (probably weights for atlatls), hammerstones, and grinding stones, as well as a large number of knives of various types: stemmed, beveled, long and narrow, and leaf-shaped (Figure 8.12). These tools were useful in processing bison and deer: the knives for cutting hides and meat, the scrapers for preparing skins; the drills for piercing holes in hides for articles of clothing and for attaching hides to dwellings; gravers for inscribing lines into bone and hides; sandstone for grinding and sharpening tools. All had to be brought in from some distance, as there are no local sources of chert or sandstone. There were pieces of paint pigment of red, yellow, and black. The site housed at least four burials that contained antler and bone tools and ornaments.

Prominent at the Doering site and other area sites studied by Wheat (1953) are ceramic sherds— fragments of Early Ceramic through Late Prehistoric Period jars and bowls (Figure 8.13). Most common are those of the style called Goose Creek, in either Plain or Incised (decorated with incised lines) variants. Goose Creek is a simple, everyday sandy paste pottery that was in widespread use throughout Southeast Texas (Aten 1983), and is an indicator of what Story (1990) termed the Mossy Grove culture, which at its end during the early Historic period had an area of distribution that roughly corresponded with the territory of the western Atakapa (see Chapter 11). Its use at these sites indicates that Native Americans were cooking with ceramics as well as storing foodstuffs and rendered oils—activities that indicate a longer presence (although seasonal) than a mere brief hunting trip.

The Doering site was stratified, and was divided into six layers, which were correlated with layers of the nearby Kobs site (41HR07; Figure 8.11A, location 2). As mentioned, a Clovis point was found in the lowest level at the Doering site, and Late Prehistoric arrow points in the top. Deer bones were found in every level at


A
Archeological Periods at Sites
Late Prehistoric
Early Ceramic
Late Archaic
Middle Archaic
Early Archaic
Late Paleoindian
Early Paleoindian
Horsepen Creek
Langham Creek
Bear Creek
S Mayde Creek
Turkey Creek
Buffalo Bayou
White Oak Bayou
Vogel Creek
Figure 8.23
Cole Creek
Brickhouse Gully
Whiteoak Bayou
Little Whiteoak Bayou
Spring Branch
Buffalo Bayou
Figure 8.15
1
2
3
4
5
6
7
8
9
5 km

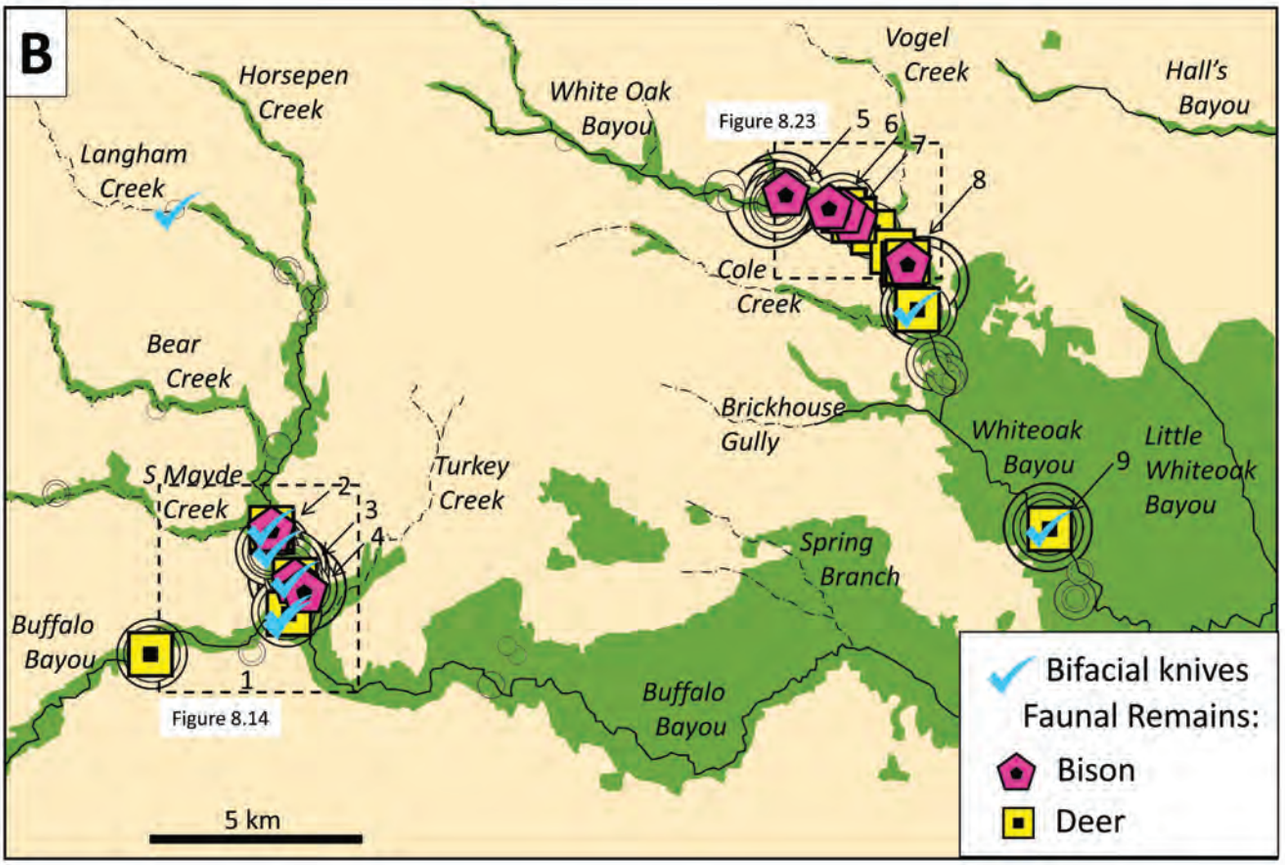

B
Horsepen Creek
Langham Creek
Bear Creek
S Mayde Creek
Turkey Creek
Buffalo Bayou
White Oak Bayou
Vogel Creek
Hall's Bayou
Figure 8.23
Cole Creek
Brickhouse Gully
Whiteoak Bayou
Little Whiteoak Bayou
Spring Branch
Buffalo Bayou
Figure 8.14
1
2
3
4
5
6
7
8
9
5 km
Bifacial knives
Faunal Remains:
Bison
Deer

Figure 8.11. Buffalo Bayou area archeological sites.

A. Archeological periods represented at sites.
B. Sites with deer or bison bones as well as bifacial knives.
See Figure 8.9 for map location.

Locations of sites mentioned in text:

1. Addicks Mound site, 41HR1
2. Kobs site, 41HR7
3. Doering site, 41HR5
4. 41HR182
5. Bison kill site, 41HR406
6. 41HR279
7. Alabonson Road site, 41HR273
8. Bison kill site, 41HR541
9. Laura Lackner site, 41HR89

both of the two sites, and bison bones were found in every level except the lowest. It was noted that bison remains were more frequently encountered in the younger layers at the Kobs site than in lower layers. Clearly, the taking of large mammals (deer and bison, and also antelope) was an important activity. Other prey included small animals like raccoon, tortoise, badger and rabbit. Fish seem not to have been important, and freshwater mussels were a minor component in Addicks area sites.

In this same cluster of sites lay site 41HR182 (location 4), excavated by Patterson (1975, 1985). Like the Doering site, this one shows evidence of very long occupation—at various times—by people of the Central Texas Balcones Tradition, the Trinity-Sabine Tradition, and the Central Coast-South Texas Tradition. The Paleoindian period is represented by the base of a lanceolate point (possibly Plainview) as well as Angostura, Early Stemmed, Early Notched, and San Patrice dart points. The long Archaic and Early Ceramic period is represented by Yarbrough, Refugio, Darl, Ellis, Gary, and Kent points (as well as by pottery sherds). The Late Prehistoric is evidenced by Alba, Perdiz, Scallorn, and Catahoula arrow points. Other artifacts included lithic tools like scrapers, gravers, and perforators, and evidence of lithic tool and point manufacture, such as hammerstones, chert cobbles from nearby rivers (Brazos or Colorado), preform chert cores for manufacturing points, large numbers of lithic flakes, and sandstone grinding surfaces, as well as evidence of the local manufacture of prismatic blades and arrow points. Other objects include fired clayballs (used as heating elements in cooking; more on this later); a piece of asphaltum, a type of hardened tar from the coast (used for hafting points); and red ochre stain on a matched set of grinding surfaces. Red ochre, used for paint and other purposes, is available from nearby sources (see Chapter 9). The few bones found at the site included a single bison tooth, evidence perhaps of the difficulty of preservation of bone material.

## Occupation chronology

As the site ages compiled on the map in Figure 8.11A show, the long period of occupation at site 41HR182 is not unusual for Katy and San Bernard prairies. The evidence of this very long history of occupation suggested to Patterson (1986) that "a stable nomadic hunting and gathering lifeway is indicated for the entire time period. A single type of lifeway and a stable settlement pattern continued from the Late Paleoindian period until European contact at the end of the Late Prehistoric . . . in spite of any possible climate variations." In general, settlement at these sites as evidenced by lithic chronology would seem continuous, but of course there is no way to establish that the site was used every year, or even every century. However, over the long haul, this and other sites of this cluster were clearly part of a favored place, favored by geography.

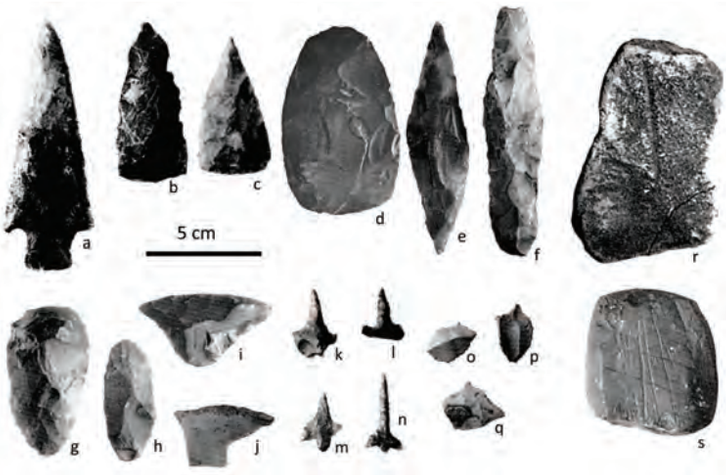



Figure 8.12. Examples of lithic tools from the Addicks Basin area, from Joe Ben Wheat (1953). A–f, knives and cutting tools; g–j, scrapers; k-n, drills; o–q, gravers (note small sharp points or spurs for graving lines into softer materials); r–s, sandstone grinding tools. Courtesy of the Bureau of American Ethnology, Smithsonian Institution.

## Site geography and interpretation of

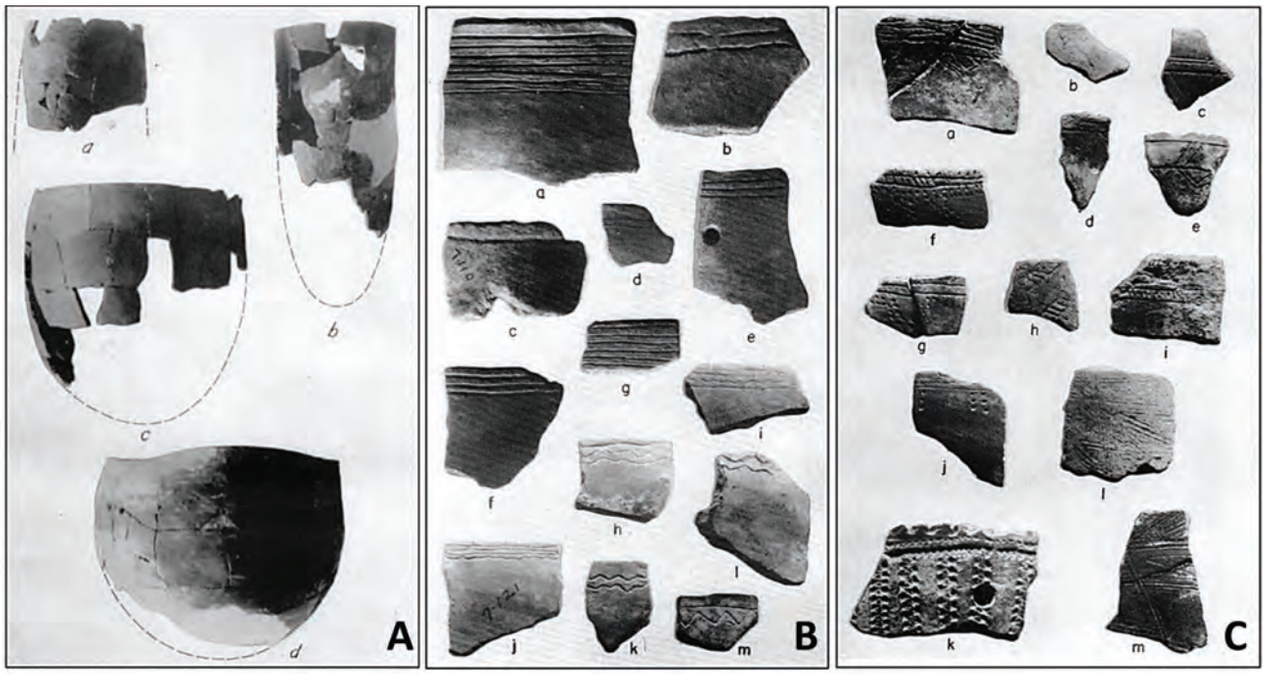



Figure 8.13. Examples of pottery sherds from the Addicks Basin area, from Joe Ben Wheat (1953), courtesy of the Bureau of American Ethnology, Smithsonian Institution. A, restored vessels of Goose Creek pottery; B, sherds of Goose Creek in-cised pottery; C, various sherds: a–j, Goose Creek incised; k, Tchefuncte stamped; l–m, undefined type.

## HUNTING TECHNIQUES

This sharply defined cluster of 28 sites at the confluence of Mayde Creek and Buffalo Bayou is at the end of a long west-facing tree-lined cul-de-sac or funnel (Figure 8.11B). As that map shows, bison and/or deer were taken at many of the sites in the cluster, at the end of the long funnel. What was causing this particular funnel to be so preferentially chosen? To analyze the situation, the archeological sites were positioned on U.S. Geological Survey topographic maps made in 1917, before the area was reshaped by flood control work beginning in the 1940s that destroyed the original topography, and with it the fragile sites (Figure 8.14). The map shows the tree-lined corridor that ends at the cluster of 28 sites. All but two of these sites lay on the *east* side of the bayou, opposite the corridor, suggesting that bison were being driven into the creek for slaughter, with hunters waiting on the east side for them to appear. The topographic map, when inspected in greater detail, shows that there were abrupt low cliffs along the gullied bayou walls, which reached as much as 2 m or more in height at location 5 on that figure, which is adjacent to a large number of excavated sites. It is reasonable to assume that that kill site was a bit like an arroyo trap, where bison dropping over the edge into the stream were momentarily confused and then killed. The height of the drop is roughly equivalent to that depicted by Catlin in his Great Plains prairie fire scene (Figure 8.7). Had the killing been due to a simple encirclement process in the natural cul-de-sac on the other side of the bayou, the campsites would more likely have been situated on the west side of the stream. Available data in this cluster of sites at Buffalo Bayou do not allow proof of the use of fire in driving game to this cluster of sites, although some archeological evidence of fire use is available in the nearby San Bernard Prairie (of which more later).

Figure 8.15 (right). Upper, the launching of a dart from an atlatl (throwing stick). Drawing by Sebastião da Silva Vieira, courtesy of Wikicommons. Lower, Late Prehis-toric to Early Historic wooden atlatls, from Key Marco excavations, Florida Gulf Coast, from Cushing, 1896.

Temporary living sites were presumably situated close to the kill—much easier there to prepare the hides, dry strips of meat over fires made from wood in the riparian forest along the streams, and otherwise cook using fired clayballs (more on clay-

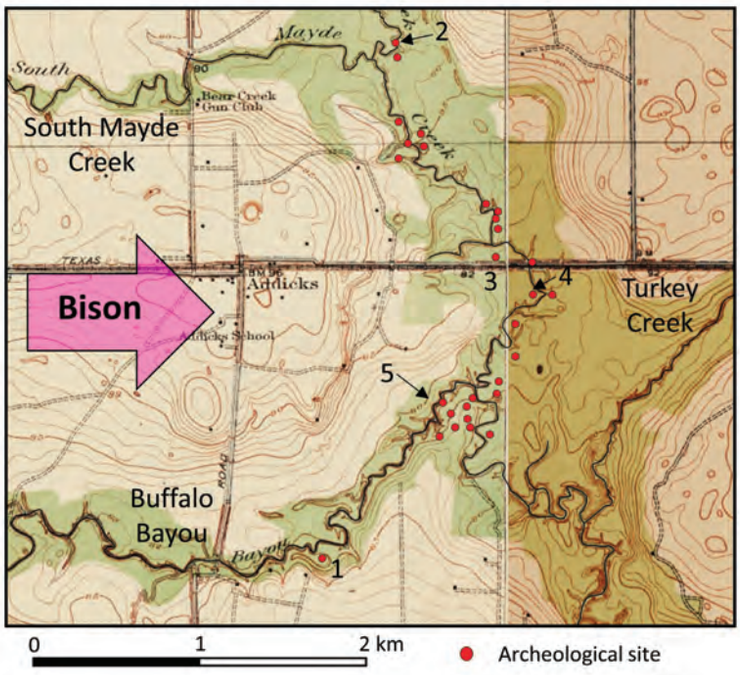



Figure 8.14. Pre-urbanization topographic map of 1917 (U.S. Geological Survey) with archeological site locations added. The creeks of this area have been heavily altered by flood control work in the middle to late twentieth century, and these former archeological sites have been destroyed. See Figure 8.11 for map location. Green shading represents tree cover. Pink arrow shows no-tional bison drive direction down the axis of the tree-lined funnel. Locations mentioned in text:

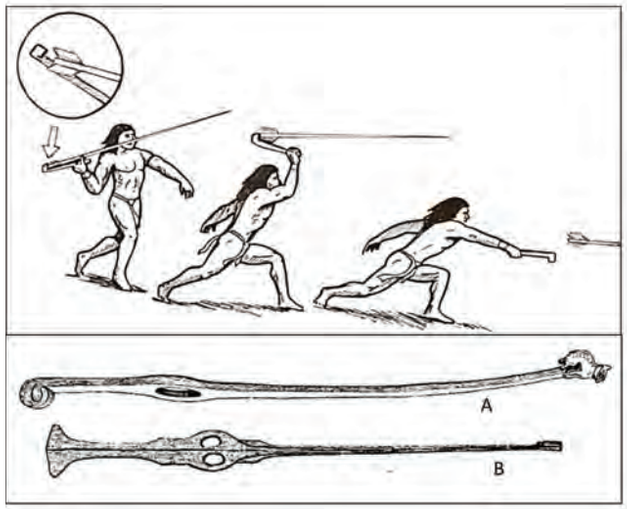
1. Addicks Mound site, 41HR1
2. Kobs site, 41HR7
3. Doering site, 41HR5
4. 41HR182
5. Heavily gullied area

ball cookery later). These sites are all situated very close to the lowland bayou, even though much higher ground is available only a hundred meters away to the northeast, southeast, and south, as can be seen on the topographic map. They are typically described by archeologists as campsites, not permanent villages (e.g., Wheat 1953), hence there was no need to place them on high ground, as by the late fall hurricane season would have been over. Also, the living quarters were conveniently downwind of wary game during the late fall and winter hunt, when winds are typically from the north-northwest.

Commonly recovered at the sites are bifacial knives, like those shown in Figure 8.12; the locations of sites with such knives are highlighted with blue check marks on Figure 8.11B. The knives are small, typically only 10 or 12 cm in length or less, but very effective in processing bison and deer. The first Europeans to see Native Americans skinning a bison were Francisco Coronado and his companions, who visited the Querecho and Teyas Indians in the plains of northeastern New Mexico and the Texas Panhandle in 1540. Pedro de Casteneda, one of Francisco Coronado's lieutenants, described how the Indians of North Texas skinned buffalo with what must have been small bifacial knives:

> *They cut the hide open at the back and pull it off at the joints, using a flint as large as a finger, tied in a little stick, with as much ease as if working with a good iron tool. They give it an edge with their own teeth. The quickness with which they do this is something worth seeing and noting.* (de Casteneda, as quoted by Winship 1896)

During the period from Early Paleoindian through Early Ceramic periods hunting of large game was primarily done with the atlatl (throwing stick). Such wooden implements are not preserved in the humid Texas coastal climate, but a number of Late Prehistoric wooden atlatls were recovered by Cushing (1896) in a Florida bog (Figure 8.15). The upper of the two atlatls shown (item A) has a carved wooden rabbit at its tip. The tail of the rabbit was a nub onto which the slightly hollowed shaft of the dart—essentially, a spear—was placed, to hold it while being thrown, as shown in the upper drawing. The emergence of the bow and arrow ended general use of the atlatl, although the two techniques overlapped for some time. Aten (1983) placed the emergence of arrow points in the Texas upper coastal area at 500–600 AD. Patterson (1992b) argued for an earlier entry of bow and arrow technology (as old



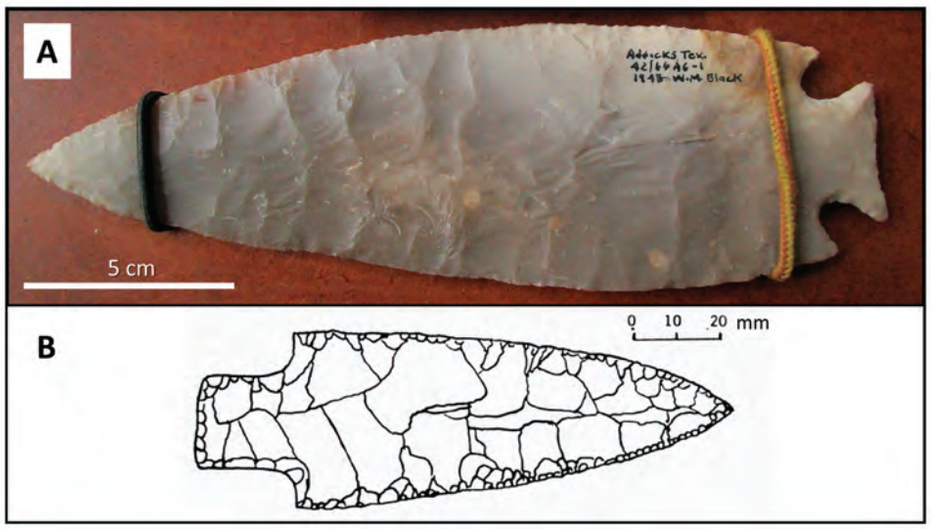



Figure 8.16. A. Large chert ceremo-nial knife, probably part of Early Ceramic to Late Prehistoric Period burial goods in the Addicks Mound (41HR1), collected by Marshall Black in 1943. From the collec-tion of the Houston Archeological Society. B. A large Nolan dart point from site 41HR279, White Oak Bayou, which probably originated in Central Texas. Such points are ascribed to the Middle Archaic. From McClure (1980). Figures are displayed at the same scale.

as the beginning of the Late Archaic), but his arguments have not met with general acceptance.

Burials at a number of sites along westernmost Buffalo Bayou and its tributaries indicate that this cluster of sites was comprised not only of very short-term hunting sites but also of sites where people lived for extended periods of time during the hunting season, perhaps all winter. Multiple burials were found by Wheat (1953) at both the Doering and Kobs sites (locations 1 and 2, Figure 8.11), and by Black (1951; also discussed by Wheat 1953) at Addicks "Mound," a fairly large earth midden located just south of Buffalo Bayou in the area of the same cluster (Figure 8.11, location 1). The midden, now destroyed, was about 1.3 m thick and rested on a natural clay knoll. Pottery fragments, arrow points, and Gary-type dart points indicate an Early Ceramic through Late Prehistoric occupation. A large chert knife found by Black was probably ceremonial, related to a burial (Figure 8.16A). A few pottery sherds found at the deepest level of the midden were assigned by Black to the "Tchefuncte stamped" variety (see Chapter 11), indicating the earliest stage of the adoption of ceramics (ca. 500–900 AD). As mentioned in Chapter 4, this site was home to a small village of Akokisa in early Historic times; the village probably fell with the entry of Anglo settlers in the early 1830s.

## White Oak Bayou archeological sites

The sites along western Buffalo Bayou and its tributaries are typically interpreted as campsites, and the positions of kill sites can only be inferred using geography. At White Oak Bayou, however, such inference is unnecessary, because a number of well-preserved bison kill sites are present that show precisely how bison were being killed. As at western Buffalo Bayou, the known archeological sites have by now been almost entirely destroyed by late twentieth-century flood control operations, where bayous were straightened and/or deepened, and the dredge spoil was thickly dropped onto the adjacent banks. Thirty-four separate sites were earlier found along this bayou, most of them in a tight cluster in the middle of the bayou's extent Figure 8.11a). It is likely that there were more sites yet undiscovered by the time that flood control earthworks took place. The sites were studied principally by William McClure in a series of reports for the Houston Archeological Society between 1975

and 1982 (see listing of McClure reports in Patterson 2005a). McClure's studies consisted mainly of salvage archeology; he worked the bayou in advance of, and sometimes during, bayou dredging and straightening activities, quickly rescuing information before it was lost. For this reason, there are few detailed excavations along White Oak Bayou, with principal exceptions at the Early Ceramic through Late Prehistoric Alabonson Road site (Ensor and Carlson 1991), and less extensive but detailed site testing for cultural resource investigations at nine sites by Prewitt and Associates, a private archeological firm (Fields 1988). Recommendations by this group for National Register of Historical Places designation at two sites (41HR541 and 41HR273) were declined, and ensuing dredging and bayou lining operations destroyed virtually all the sites.

### Bison kill sites

Several sites document individual bison kills along White Oak Bayou (Figure 8.11B). The site 41HR406 (location 5) contains the skeletal remains of a large male bison, found in situ on the west bank of the bayou, weathering out of a small steep-sided gully (since filled with sediment) that emptied into the adjacent bayou; the bison appears to have been driven into the gully while being hunted. A Perdiz point was found associated with the remains (a "metal point" originally reported as inserted into a vertebra was later reclassified as not a point), indicating that the bison was killed during the Late Prehistoric Period (Fields 1988). At 41HR541, a short distance to the southeast and also along the bayou (location 8), another single bison kill has been reported (McReynolds et al. 1988; Ensor 1990). Four arrow points were associated with the remains, including Perdiz and Perdiz-like (Alba). Radiocarbon dates of bone and associated wood charcoal yield an estimated time range for the kill of AD 1300–1700 (Late Prehistoric Period).

At an unnumbered site one mile upstream of site 41HR406, a nearly complete skeleton of an adult male bison was found in 1981 (Dickens 1984). The remains were found eroding from the bank of the channel, about 9 feet below the top of the west bank and 7 feet above the water line. Two hind legs and one foreleg were still articulated, and the body lay parallel to the stream channel. Four arrow points were found: beneath the jaw (a Perdiz arrow point), in a joint between the humerus and tibia (Catahoula arrow point), in between the fourth and fifth ribs (Fresno arrow point), and in a small pile of bone fragments and vertebrae (unclassified dart point). Excavation established that the bison skeleton was lying at the bottom of a small creek that flowed at an angle to the present bayou. Flint chips and pottery sherds were found in the vicinity of the skeleton but probably were washed in with the fill. The evidence suggested to Dickens that the animal was first wounded in the leg by an arrow, then the bison was chased over the stream bank, falling into the small stream channel, where it was finally dispatched with a hand-held spear or a dart point, and butchered in place. The lithic points establish a Late Prehistoric time period.

Another nearly complete bison skeleton was found, along with scattered deer bones, at 41HR279 (Figure 8.11A, location 6). Among the bones was a Middle Archaic Nolan flint point, from the Central Texas Balcones Tradition, suggesting that

not only Trinity-Sabine Tradition hunters were here (Figure 8.16B, McClure 1980). The Nolan point was not directly associated with the bison skeleton, however. The site had a long occupation history with a mixture of Central Texas Balcones and Trinity-Sabine points, including an Early to Middle Archaic Trinity point, a Middle Archaic Lange point, Late Archaic Pedernales, Gary and Kent points, and Late Prehistoric Perdiz arrow points (McClure 1979c). Numerous deer bones and antlers (some used as tools) were also found (McClure 1979b).

Although bison kill sites are impressive, deer remains are also present, and in fact their remains are more prevalent than those of bison at a number of sites. At the Alabonson Road site (41HR273; Figure 8.11B, location 7), detailed excavations reveal an Early Ceramic occupation of duration 1600–1200 BP succeeded by a Late Prehistoric settlement (Ensor and Carlson 1991). The Early Ceramic occupation was interpreted as a base camp where full use was made of bayou and prairie resources, including flora and fauna. The primary large mammal consumed is interpreted to have been deer, as evidenced by 338 identified bone fragments at all layers of the site. The abundant deer skeletal remains, some with butcher marks, typically consist only of selected parts—especially cranial and leg parts—suggesting that butchered meat was being taken back to the camp from a more distant kill site. Cut marks were found near limb joints of some specimens.

At Alabonson, only a handful of "bovid" (probably bison) remains were found, in the uppermost levels of the site (probably Late Prehistoric). The Laura Lackner site (41HR89; location 9) had been badly damaged by twentieth-century development but still yielded lithic evidence of a long occupation from Early Paleoindian through Early Ceramic time. It contained deer and small mammal remains but no bison bones (McClure 1976, 1986a). It would seem from the absence of bison remains at these two sites, and abundance of deer remains, that bison were rare during the Early Ceramic period; the implications of this for periodic absence of bison in the region are discussed at the end of this chapter.

## Ceramics

Nearly all the sites noted along White Oak Bayou contained ceramic sherds, indicating that such everyday activities as cooking, storage of foodstuffs, and rendering of fats for oil (to be stored in jars) occurred here. At site 41HR279 (Figure 8.11A, location 6), 1,241 sherds were found, of which 1,219 were of the type Goose Creek Plain, an everyday variety of sandy paste pottery that is the standard at most coastal and inland Early Ceramic and Late Prehistoric sites (Aten 1983). Several jars and a bowl were partly reconstructed by Fields and others (1988; Figure 8.17). Other sherds included many of the type Goose Creek Incised, where decorative incisions were made along the rims (Figure 8.18). They are indistinguishable from those found at the cluster of Buffalo Bayou sites (Figure 8.13) and those found along the coast.

The occurrence and abundance of Goose Creek Plain ceramic sherds across the study region is displayed in Figure 8.19. The greatest abundance of such sherds is found at sites in the coastal area,

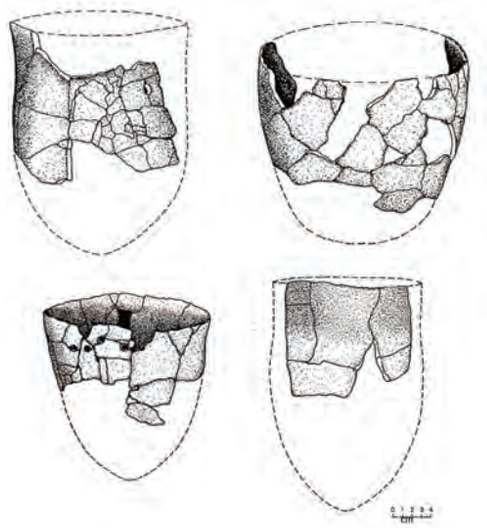


Figure 8.17. Four reconstructed ceramic vessels, all from 41HR279, White Oak Bayou. All are of the Goose Creek Plain style. Drawings from Fields (1988), courtesy of the U.S. Army Corps of Engineers.

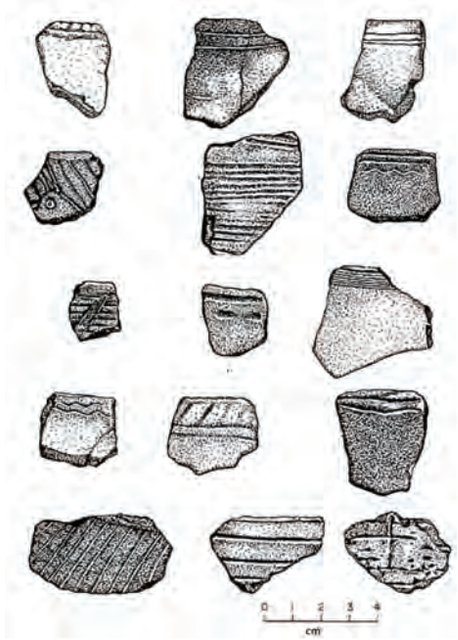


Figure 8.18. Representative ceramic rim and body sherds from White Oak Bayou sites 41HR89, 284, 302, 241, and 279. Bottom right sherd is Tchefuncte Stamped; remainder are all Goose Creek Incised. Drawings from Fields (1988), courtesy of the U.S. Army Corps of Engineers.

where such jars were known to have been useful in boiling shellfish, as interpreted at shell midden sites (Chapter 6). The fact that they are also ubiquitous, though less abundant, at sites in the inland prairie hunting lifeway zone (pink shading in the figure) suggests that they were useful for either cooking or storage (or both) at these inland sites as well. The lesser abundance at inland sites relative to the coast might suggest that pots were not fabricated there, but were brought to inland areas. Alternately, the greater coastal abundance might signify that the coastal sites were occupied for a greater part of the year, as was suggested by Aten (1983). Site 41HR279 on White Oak Bayou is atypically rich in sherds (location 1, Figure 8.19). Because Beaumont Formation clay suitable for sandy paste pottery is available throughout all but the northern and northwesternmost parts of the study area, it may be that ceramics like those in Figure 8.17 were manufactured locally, and that the sites were occupied at each visit for longer than just a camping trip. As we have seen, Spanish visitors in 1746 came upon Akokisa and Bidai "winter villages" in February on the Katy Prairie. These hunters may have been inland for several weeks or a few months at a time, which would allow simple ceramics to have been prepared, and then abandoned as refuse at the end of the season.

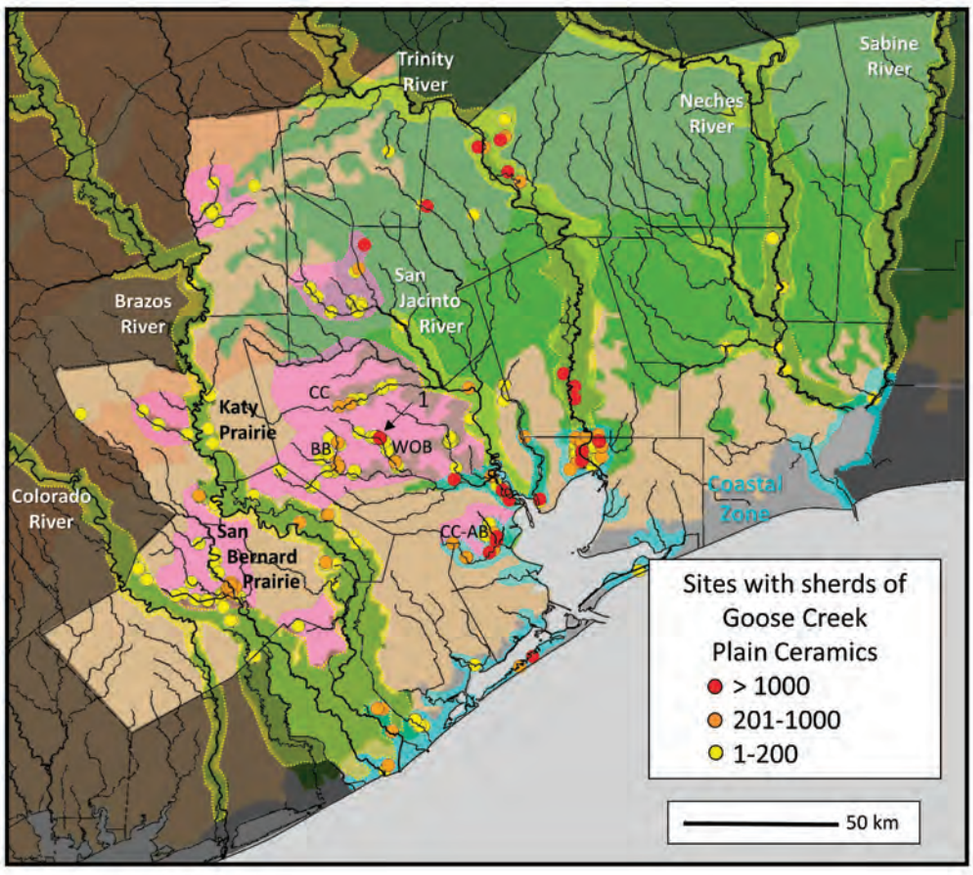



Figure 8.19. Occurrence and relative abundance of ceramic sherds of the type Goose Creek Plain in the project database. Ceramics are most abundant in coastal areas, and site 41HR279 (location 1) on White Oak Bayou is somewhat of an aberra-tion. Abbreviations: CC, Cypress Creek; CC-AB, Clear Creek-Armand Bayou area; BB, Buffalo Bayou; WOB, White Oak Bayou. Base map depicts lifeway zones layered over a map of ecoregions (see Figures 8.1 and 3.7 for legend).

## Fired clayballs and hearths

Several sites along White Oak Bayou included earthen cooking hearths filled partly with fired clay balls (e.g., 41HR279; McClure 1979a). Fired clayballs are a feature of Katy and San Bernard prairie sites: hand-rounded lumps of clay that have been fire-hardened, yielding a reddish color, with blackening as a result of their tempering and use. Figure 8.20 shows examples, excavated from 41WH19 in the San Bernard Prairie. Fired clayballs are often found within or around earthen hearths (typically, simple pits), and the general interpretation has been that clayballs were somehow used—in the absence of local supplies of stone—as heating elements during cooking (Patterson 1995c, 1995). At the Morhiss Mound archeological site on the Guadalupe River south of Victoria, a hearth with fired clayballs was found not far from another hearth that had a fill consisting of river-rounded stones. Other hearths found nearby at that site contained both fired clayballs and stones, demonstrating that the two types of artifacts were used interchangeably in cooking (Dockall and Black 2006).

Figure 8.20. Fired clayballs, from site 41WH19, San Bernard Prairie. Note the red and yellowish colors, due to firing, and the black char-ring. Once fired and baked, these clayballs—acting somewhat like soft bricks—could hold together in water. They could be used as a heating element (thermal storage device) to boil water, or could be buried in pits as simple heating elements in baking meat. From the collections of the Houston Archeological Society.

Just to the west of the Katy and San Bernard prairies, archeological sites along the Colorado River reflect use of the river cobbles available there (there are no such large cobbles available below about the town of Wharton in Wharton County). Examples of sites with rounded stone-filled pit hearths of the size and sub-rounded shape of the fired clayball hearths at 41HR279 can be found at the Cotton Field site in Colorado County (41CD155), a few miles west of Eagle Lake (Barrett 2016), and at the McKinney Roughs site (41BP627) near Bastrop (Carpenter and Miller 2007). Both sites are close to the Colorado River and yielded rounded cobbles from the river. Because the river cobbles were available, there was no need to manufacture fired clayballs for cooking. Both sites display heat cracking that split the cobbles, as is seen with clayballs at the Katy and San Bernard prairie sites.

At site 41HR279 on White Oak Bayou (McClure 1979a), a one-meter-long in-ground hearth was exposed in the stream cut, filled with rough lumps of clay (and later buried by stream sediment). The lumps were reddish brown to gray in color, evidence of firing. Arrow points embedded in mud beneath the hearth indicated a Late Prehistoric age for the hearth, and a skeleton of a bison was uncovered in alluvial deposits immediately overlying the hearth—unrelated to the hearth that preceded it, but indicative of the hunting of bison in the area around the hearth (McClure 1979a, 1979c). In the San Bernard Prairie at site 41WH19, discussed later, fired clayballs have been radiometrically dated at 7,970 rcyBP, or lowest Early Archaic (Patterson 1996), and were found scattered throughout strata at that site that dated from the Early Paleoindian through Late Prehistoric periods, so a very long period of site use can be assumed. At site 41FB42 in the San Bernard Prairie, not far from site 41WH19, a total of 15,188 clayballs were found, evidence of a lot of food preparation over a long period of time (Patterson et al. 1993b).

Numerous other sites along White Oak Bayou contained either earthen hearths

Figure 8.21. An earthen hearth with fired clayballs, excavated in 2012 at Dimond Knoll on western Cypress Creek adjacent to the Katy Prairie. Photo courtesy of Coastal Environments, Inc. and TxDOT.

or fired clayballs or both, including nearby 41HR278 (McClure 1980), where three such earthen hearths associated with clayballs were found. There are numerous sites with clayballs at nearby Cypress Creek as well. An intact earthen hearth with numerous fired clayballs was recently excavated at Dimond Knoll on Cypress Creek (Figure 8.21, from Barrett 2018). It is approximately the same size and sub-rounded shape as that found at 41WH279, and those at 41WH278, both on White Oak Bayou, and is likewise filled with fist- to grapefruit-sized fired clayballs.

Heated in the fire, fired clayballs could retain heat much longer than coals alone. Hudgins (1993) experimented with roasting meat with clayballs in a pit; the clayballs were heated by fire, then meat was placed on top of them and then buried; roasting-level heat was retained for over two hours, much longer than with buried coals alone. Going back to the White Oak Bayou pit hearth at 41HR279 for a moment, one characteristic of the pit was puzzling, suggesting that the Native Americans were doing something different than pit roasting at this site. Observing the clay in the wall of the pit that surrounded the stones, "the clay was fire-stained but had not become fired as had the clay lumps in the hearth" (McClure 1979a).

The primary use of heated rock by northern Plains tribes in the modern era was in boiling food, not roasting. Wissler (1966) reported that Plains Indians would boil fresh bison parts in an impromptu earthen hearth, using heated stones:

> *Often the fresh hide of a buffalo was used, pushed down into a hole in the ground. A hunting or war party on the march sometimes killed a buffalo in the evening, turned the carcass on its back, removed the viscera, put water, blood, and some soft parts of the animal into the cavity and then with hot stones prepared a feast, using the body of the unfortunate animal as a kettle in which to boil him.*

The Plains Cree also used this method in preparing bison meat: "An old method of cooking food . . . entailed digging a pit which was lined with a green hide pegged to the ground around its rim. Meat and water were placed in the pocket

and brought to a boil by adding hot stones" (Mandelbaum 1979). The name of one northern Plains tribe, the Assiniboine, means "stone Sioux," because they cooked meat primarily with heated stones (Bryce 1893). The transport of hot stones to a hide-lined earthen pit would be consistent with the lack of firing of the clay lining of the pit at 41WH279. By the time the hot rocks (or clayballs) were placed in the pit, it had been lined with hide and filled with water, so no firing of the pit itself would occur.

At the Head-Smashed-In buffalo jump site in southern Alberta, a mass kill site that had been used for 6,000 years, buffalo were driven over a cliff, and the carcasses were then processed at a nearby camp. In the camp area, researchers were puzzled by small clusters of thousands of heat-cracked rocks that were not local; they had been brought in. Many of the stones were found in groups that filled sub-round-shaped in-ground pits of about half a meter to one meter in diameter that had been dug into the prairie soil (Brink 2008)—similar to the scale of the pit hearths at 41WH279 and at Dimond Knoll. Researchers estimated that about 4 million kg (5,000 tons) of rock had been brought in at Head-Smashed-In, mute evidence of thousands of years of cooking. The archeologists deduced that the Native Americans had been using the method described by Wissler and by other ethnohistoric sources, and the archeologists experimentally replicated the process. Rocks were heated in a fire, then transferred using a green forked stick to a pit lined with a raw bison skin and filled with water and meat. They found that the local sandstone was not up to the task of being heated and reheated, and fell apart in use, but that imported quartzite from a few miles away stood up better to such heating and reheating, although it too often cracked from the heat treatment of recurrent use. The site is littered with small fragmented quartzite pieces as a result. Collins (2011) suggested that a similar stone boiling technique was used by Archaic and younger hunters in the Edwards Plateau of central Texas.

Fired clay, once heated, also tends to fracture upon the thermal shock of being placed in water, leading Webb (1968), in discussing the 12,000 such objects found at Poverty Point in Louisiana, to suggest that pit roasting was its primary function, the idea being that pit firing lacked the thermal shock of water immersion. The large amounts of cracked, small pieces of quartzite at Head-Smashed-In, however, suggests that widespread thermal cracking of stone was not a non-starter for boiling there (Brink 2008), so it may be that Southeast Texas cooks were equally tolerant of the thermal cracking of fired clay. Replacement clay lumps are easy enough to manufacture.

There is local evidence for pit roasting in a different sort of hearth. A sandstone hearth was found along the San Bernard River, near the San Bernard Prairie in Wharton County (41WH50; Patterson and Hudgins 1988). Two large sandstone slabs were found in a rock midden overlying a caliche bed. The sandstone, apparently from nearby outcrops along the San Bernard River, formed a rounded midden of about 0.8 m in diameter, and the investigators assumed that it was associated with cooking. Unfortunately, they do not mention whether the sandstone showed signs of firing. Although fired clayballs were found elsewhere at the site, there are none described as directly associated with the sandstone feature. Archeologists at Heads-Smashed-In found a number of pit hearths with sandstone bottoms and built a

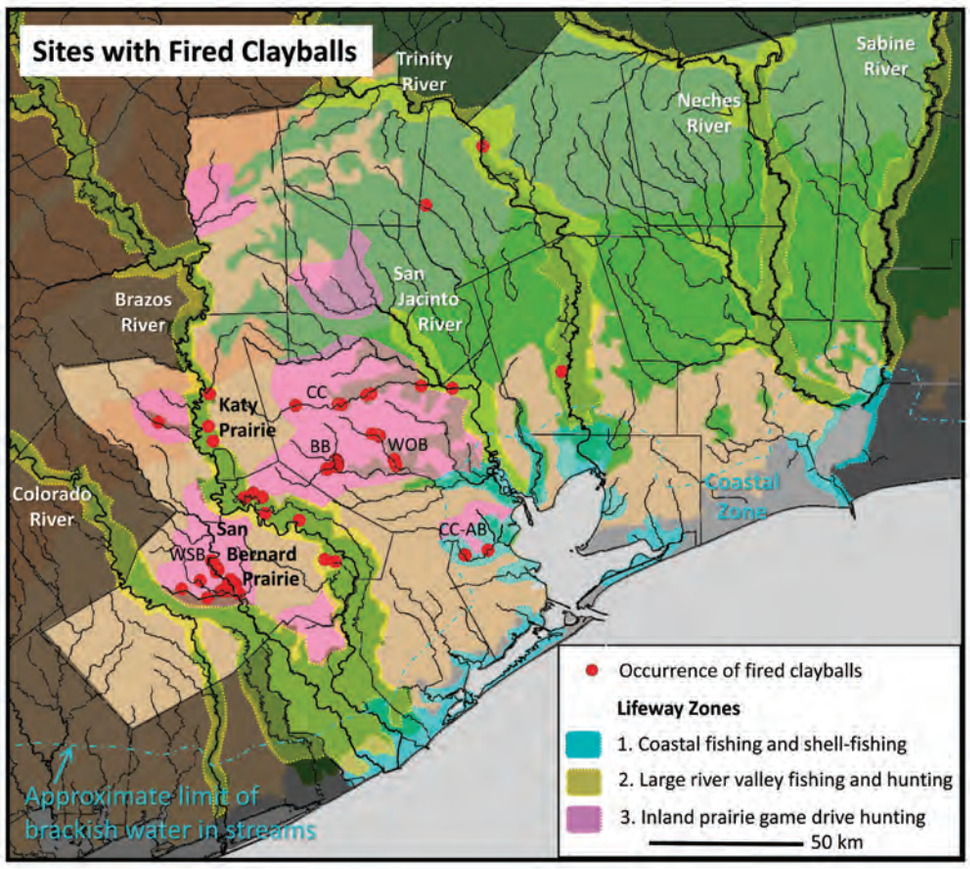



Figure 8.22. Occurrence of fired clayballs in sites of the project database. Clayball locations are heavily skewed to the western prairie hunting areas (pink zones as well as adjacent parts of the Brazos River), where fired clayballs are inferred to have been used in cooking bison meat. Locations: CC, Cypress Creek; CC-AB, Clear Creek-Armand Bayou area; BB, Buffalo Bayou; WOB, White Oak Bayou; WSB, West San Bernard River; KP, Katy Prairie; SBP, San Bernard Prairie. Base map depicts lifeway zones (as in Figure 8.1) over ecoregions (Figure 3.7).

modern version to study their use. Sandstone was seen as an effective way of reflecting heat during roasting, and historic accounts mention area Native Americans using such sandstone pits to roast meat. Whether the sandstone feature at 41WH50 was used in such a way is not known.

Locations of sites in the entire project database area where fired clayballs were found are shown in Figure 8.22. Clayballs are sharply focused in the inland prairie hunting zone, which is consistent with their use in the preparation of meat, especially bison—or else they would be more commonly found in coastal zones, where culinary fare was dominated by fish, shellfish and small mammals (Chapter 6). Moreover, deer are commonly found at these sites outside the prairies, and yet clayballs are largely absent—suggesting that fired clayballs appear to be associated with bison. Clayballs range in age from Paleoindian through Late Prehistoric, as evidenced from stratified sites like the Owen site on Cypress Creek (41HR315), and 41WH19 and the Ferguson site (41FB42) in the San Bernard Prairie, discussed later (Patterson 1989c). Of interest is the continuation of clayball use into the Early Ceramic and Late Prehistoric periods, when pottery was available for cooking; such was the case at numerous sites in the area. Perhaps clayballs were used in pots as well as in hide-covered pits.

### White Oak site geography and interpretation of hunting techniques

Unlike the Buffalo Bayou sites, the White Oak sites are not located at the end of

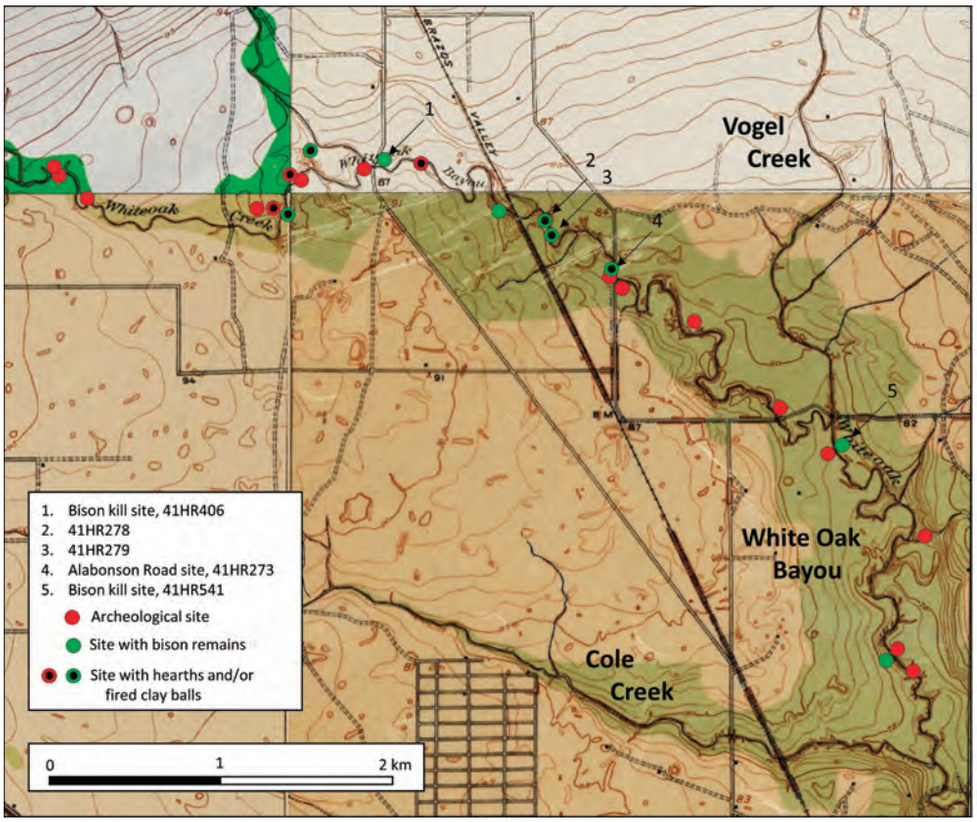



Figure 8.23. Pre-urbanization topo-graphic maps of White Oak Bayou from 1917 and later (U.S. Geological Survey) to which are added archeological site locations. The creeks of this area have been subsequently heavily altered by straightening, re-positioning, widening and deepening in the middle to late 20th century, and these archeological sites – studied in the 1940s to 1970s – were largely destroyed by flood control work and adjacent urban construction. See Figure 8.11 for location. Green shading represents tree cover.

a tree-lined funnel with a clearly defined cul-de-sac. As is the case at the western Buffalo Bayou sites, it is difficult to get a sense of the detailed geography of these now destroyed White Oak sites because of the heavy degree of stream straightening, widening, and deepening that occurred in the late twentieth century, including burial of the adjacent banks under spoil heaps as well as burial beneath dense numbers of urban structures and roads. By transferring site locations from modern maps to pre-development topographic maps from 1915–1917, one can get a view of the previous terrain. Figure 8.23 shows the locations of 26 sites along the central part of then tree-lined White Oak Bayou.

The sites as originally surveyed were tightly clustered along both sides of the bayou's inner channel walls. The sites are all located in what would today be considered the bayou's low-elevation floodway. Clearly, these were primarily temporary camp locations, because much higher ground was available only a few tens of meters away in the adjacent prairies, and that higher ground would have been needed perhaps several times a year during high rainfall. Most individual sites extend for some distance along the eroding stream bank; for example, the locations of artifacts at site 41HR282 were strung out for about 300 feet along the bank. This would suggest that the actual occupation area would fill in most of the area along this portion of White Oak Bayou, but of course that occupation would have occurred piecemeal at discrete, different times.

The several documented Late Pleistocene bison kill sites on White Oak Bayou already described indicate that those bison were being driven into the small, narrow stream channel (or into adjacent gullies that drained into it) and then killed. The multiple and different arrow points recovered in two of the kills demonstrates

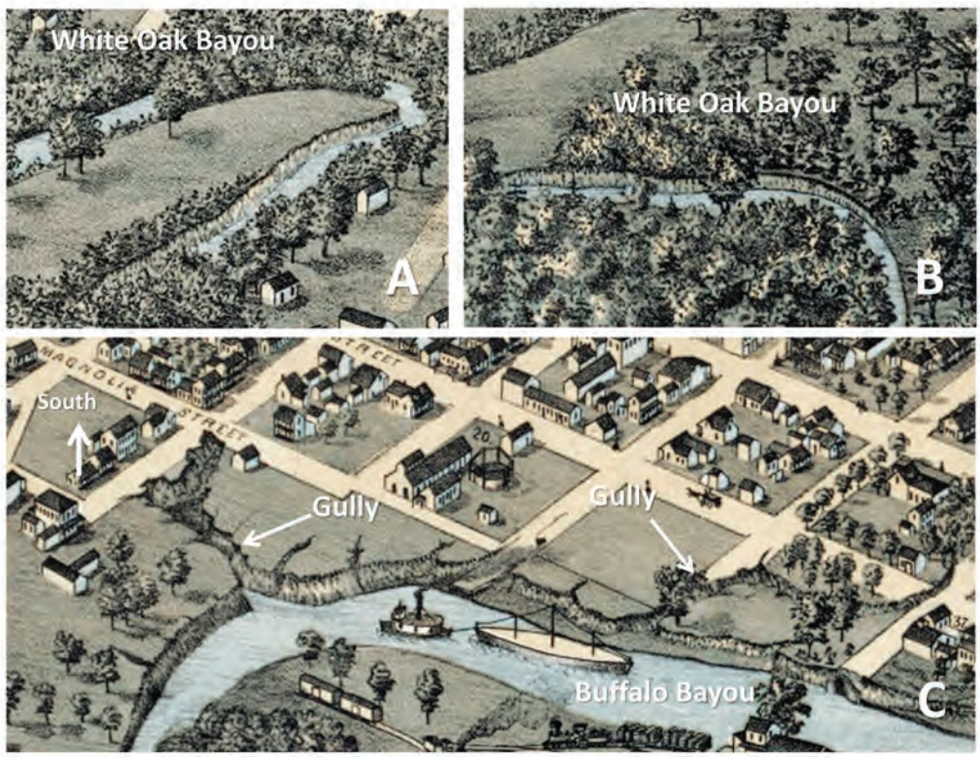



Figure 8.24. Three small parts of a bird's-eye perspective map of Hous-ton in 1873 that show the steeply gullied, incised_ topography of parts of Houston's bayous. A and B depict portions of White Oak Bayou and its steep banks directly north of modern downtown Houston. C shows a portion of the city along Buffalo Bayou, east of Allen's Landing, which is just out of view to the right. Note two prominent steep-walled gullies draining into the bayou; these have since been filled in. All views are oriented to the south. Map courtesy of the Houston Metropolitan ResearchCenter.

Figure 8.25. A scene on White Oak Bayou north of Houston, 1890. Note the high bank to the right, and the cypress trees in the bayou at center. Courtesy of the Rice Digital Scholarship Archive and the Houston Metropolitan Research Center.

communal kill activity, not just a lone hunter. The most accurate pre-channelization topographic map of the area, the USGS map of 1955, shows an average of ten feet between the stream level and the top of the encasing inner channel wall of the bayou. Portions of a birds-eye perspective map of Houston from 1873 show similarly steep banks of White Oak Bayou just north of modern downtown (Figure 8.24A, 8.24B). A photograph of a part of White Oak Bayou from 1890 (Figure 8.25) provides a typical view; the orientation of the photo is not known. The stream bank on the right is perhaps 3 meters in height and faces an opposing bank that is hidden by vegetation. The bayou watercourse itself is perhaps 7–8 meters wide and has cypress trees (at the center of the photo) growing within it. A possible kill scenario is that bison or perhaps deer, driven by fire or by human "beaters," would emerge from the far bank into the water, where they would be momentarily slowed down by swimming, by losing footing in the mud of the stream bottom, or by stumbling on mats of slick cypress knees. Late Prehistoric Period hunters would be waiting on the near bank and would launch their arrows downward into their slowed prey.

At site 41HR406 (location 1, Figure 8.23) and at an unnumbered site a mile upstream of site 41HR406, the kills were made in small gully-like streams that drained into the larger bayou. In the days before urbanization of the Houston area, there were many such steep-walled gullies, most of which have since filled in. Both the former steep-walled banks of the bayou and the steep-walled gullies that drained into it were incised during periods of Pleistocene sea level fall. Figure 8.24C shows examples of steep-walled

gullies in the eastern downtown area of modern Houston, as they appeared in 1873, draining into Buffalo Bayou, which shows steep banks. Those gullies have long since been filled, but they give an impression of the type of gullied topography that was used to advantage as kill sites along White Oak Bayou. Houstonians can see a steep gully in the garden of the Bayou Bend museum, which provides a preserved, modern day example. The suspension footbridge at that property also gives a good perspective of the steep banks of adjoining Buffalo Bayou and of the drop in height (about 6 to 10 meters) from the now urban prairie to the stream bed below; this is one part of that bayou that has not been altered by modern flood control work. Once large game was coaxed into such gullies or into White Oak Bayou itself, hunters could stand safely above and dispatch their prey.

In all cases White Oak Bayou is the defining geographic element, a barrier to herds heading, probably under pressure, either southward or northward. Figure 8.26 displays an aerial perspective view, looking to the north, taken in 1944 prior to urbanization of the area. White Oak Bayou is fringed with a narrow band of riparian forest and is surrounded by what was formerly a tallgrass prairie, with many natural pothole wetlands that would have been magnets for bison and deer. The prairie extends for miles northward to Cypress and Spring creeks, near the horizon in the aerial view. It seems a reasonable interpretation that prey, propelled across the prairie by humans, would ultimately flee into the creek, where hunters would wait. The bison kill sites show that hunting happened at various widely spaced places along the bayou, suggesting that beating game forward was an inexact science; there does not seem to be one favored place (for example, a favored especially high or steep bank) that was utilized. Of the scenarios described from ethnohistorical sources (Chapter 4), the fire drive is a prime candidate for moving bison to the bayou kill sites in the millennia before horses arrived on the scene.

As mentioned, it is not clear from the locations of the archeological sites in which direction bison were presumably driven along the portion of White Oak

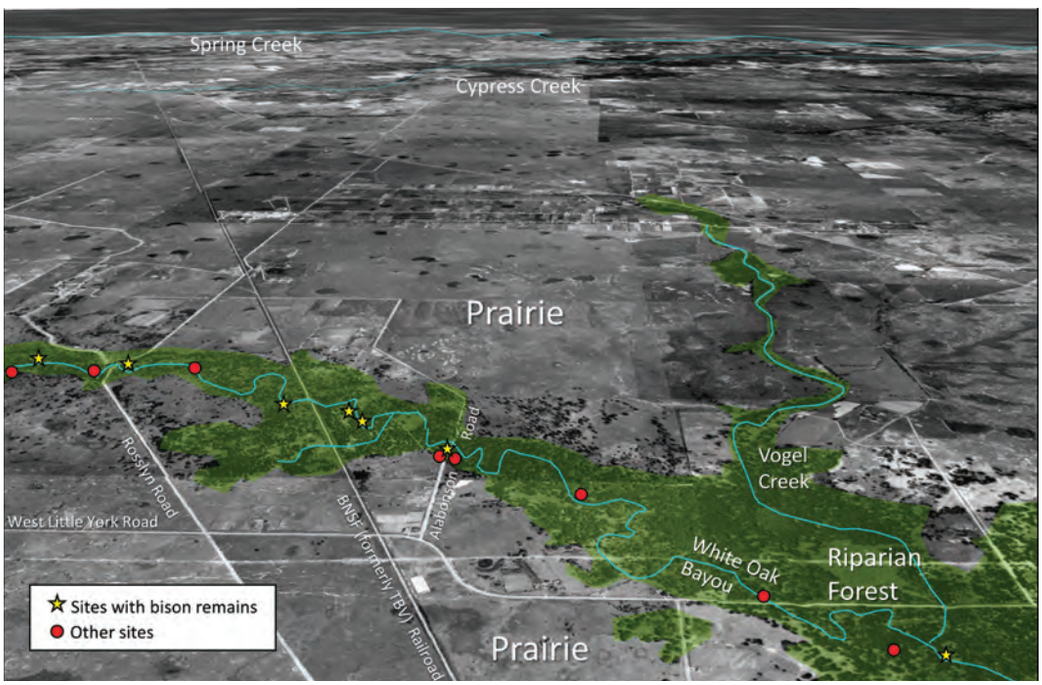



Figure 8.26. Bird's-eye (inclined) view looking north at White Oak Bayou and surrounding prairie in 1944, prior to channel-ization, deepening, and straightening of the bayou in the late 1950s through 1970s. The former prairie north of the bayou stretched all the way to Spring Creek (near the horizon) and contained extensive pothole wetlands. Locations of archeological sites are shown (highlighting those with bison remains); these sites were essentially destroyed or buried by levees during flood control work, and the former prairie landscape is now replaced by dense residential developments.

Bayou west of its intersection with Vogel Creek (Figures 8.4 and 8.11). Farther south from Vogel Creek, for example at the Lackner site (location 9, Figure 8.11) it seems clear that they were driven eastward, as there was a thick forest to the east of the bayou at the Lackner site.

Because these sites contain evidence of a very long occupation from the Early Paleoindian through Late Prehistoric periods, and are tightly located along the rim of the inner bayou wall, they can be interpreted as showing that the hunting lifestyle practiced by these Native American people changed little over the years, at least until the advent of the Early Ceramic, when pottery was introduced, and the Late Prehistoric, when the bow and arrow was adopted. As can be seen in Figure 8.11A, there is an abrupt increase in numbers of sites of these later times relative to the Paleoindian and Archaic periods. As emntioined above, prominent use of ceramics at these sites, especially at site 41HR279, suggests that some ceramics were made locally, indicating a relatively long period of seasonal occupation—not long enough for spring floods and summer hurricanes, perhaps, as flooding would render these lowland sites often uninhabitable; but long enough to amount to a considerable period of time in the late fall and winter.

The location of cooking sites right on the creek, as near as possible to the location of bison kill sites, suggests that bison were rendered and processed as close as possible to kill sites. Bison (and deer) skins were carefully prepared and tanned for clothing, for blankets, and for covering of shelters; fat was rendered and combined with smoke-dried meat for pemmican. All these things took time, and it was necessary to do them near wood and water.

The situation with the hunting of deer is somewhat different. The findings at the Alabonson site discussed earlier demonstrate that deer were harvested somewhere away from the campsite; leg quarters were apparently taken to camp and the rest of the carcass was left behind at the unknown kill sites. This suggests a different hunting strategy. If deer hunting was a communal activity, as suggested by ethnohistoric accounts, that might have entailed encircling the deer on the prairie, perhaps using fire in the manner observed by Cabeza de Vaca in coastal Texas in 1530, by Charlevoix in the Mississippi Valley in 1758, and by Nicholas Perrault in Iowa in the late 1600s, as discussed earlier. The deer would have been killed on the prairie and butchered into quarters there, consistent with the observed faunal remains at Alabonson.

## Cypress Creek archeological sites

Cypress Creek is the northernmost former hunting zone on the Katy Prairie. It diverges from Spring Creek near the town of Spring, and the two streams partly surround a large prairie that opens to the west (Figure 8.27). Published archeological surveys along the creek have consisted mainly of surface collections of lithic items, with the exception of detailed excavations at the Owen site (41HR315: Patterson 1980; location 2) and the Dimond Knoll site (41HR796: Barrett and Weinstein 2014; detailed results not yet released; location 1). Another detailed excavation at 41HR991 (location 6) yielded an Early Ceramic and Late Prehistoric assemblage, with a hint of earlier occupation (Driver 2011). With the exception of the Dimond

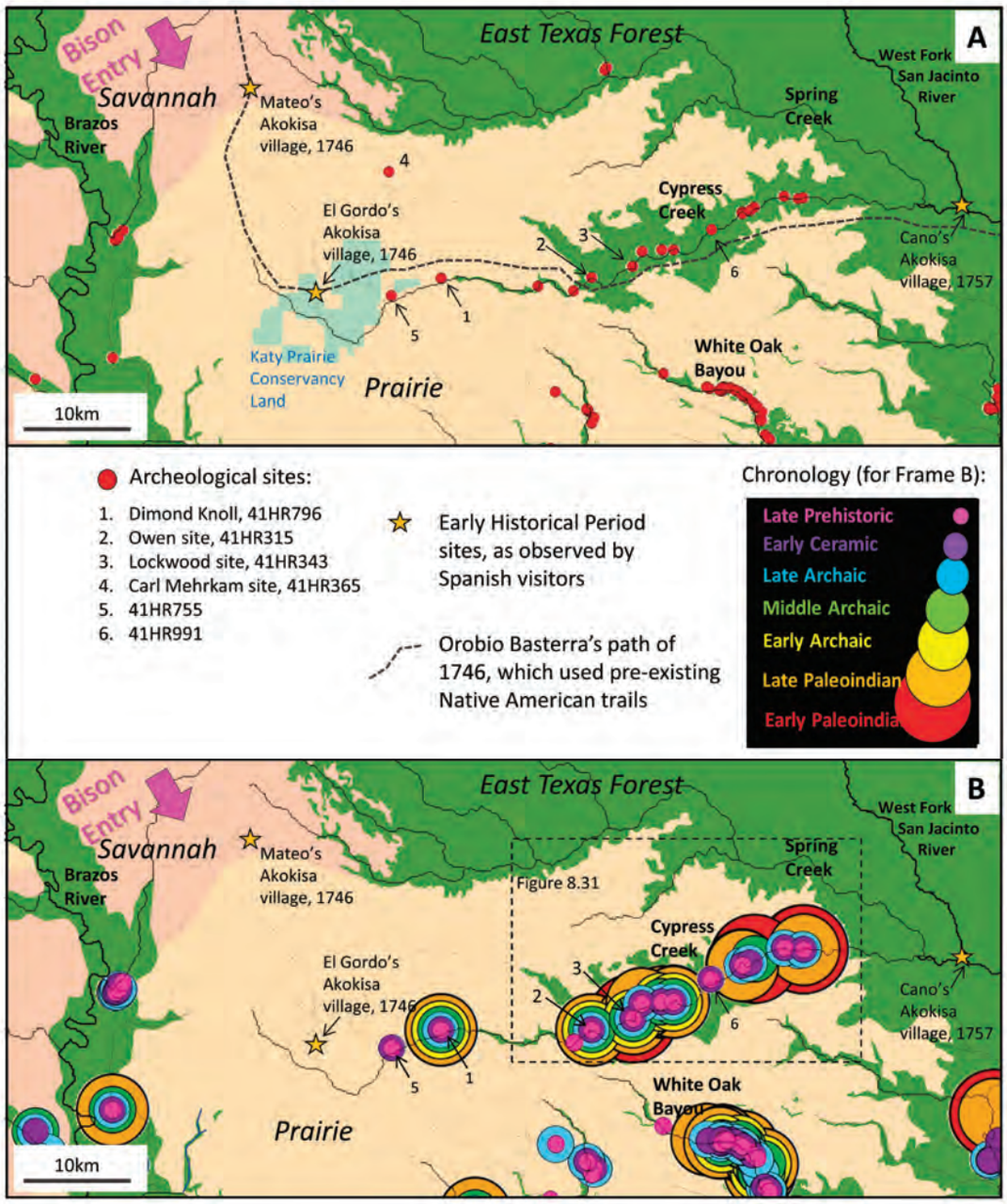



Figure 8.27. Cypress Creek archeological sites and related early Historical Period features. Frame A. Locations of sites. Frame B. Site chronology. See Figure 8.9 for map location.

Knoll and 41HR991 sites, all published studies are from the 1970s to early 1990s. Much of the creek has since been straightened, widened, and deepened by flood control, destroying many of the sites. The Owen site was destroyed by construction activities, and Dimond Knoll was excavated as a salvage project that lay in the path of the construction of Grand Parkway. After completion of archeological excavation by the Houston Archeological Society and TxDOT in 2014, the Dimond Knoll site was covered in concrete to protect several unexcavated burials found there, and the Grand Parkway was built more or less over the top of it (Barrett 2014). Acidic soil chemistry at most of the Cypress Creek site is such that bone recovery is slight; at the Owens and Driver sites, for example, only small pieces of deer and turtle bones were recovered, despite the presence of a reasonably stratified soil midden. Dissolution is only part of the problem; the creek at flood stage has a tendency to

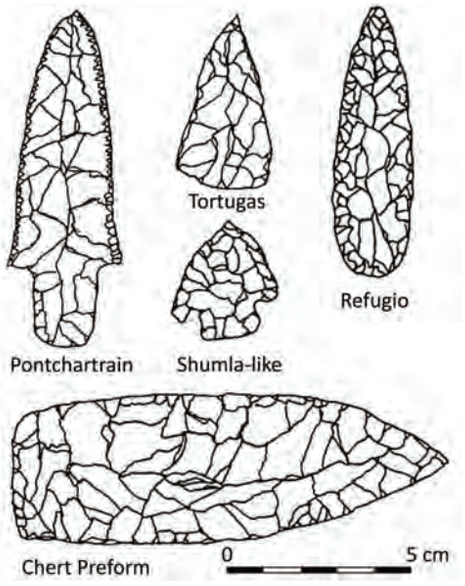



Figure 8.28. Late Archaic points and a chert preform from the Owens site (41HR315), Cypress Creek. The Pontchartrain point is found mainly in southern Louisiana but extends into Southeast Texas. The Tortuga, Shumla, and Refugio points are typically found in south and central Texas and northern Mexico. From Patterson (1980).

redistribute deposits along its length, as was seen at Dimond Knoll and discussed previously in Chapter 5. Some of the surface collections made along Cypress Creek come from deflated middens, where stone projectile points—being relatively heavy—are all that remains of winnowed deposits during periodic flooding, yielding what is essentially a surface pebble lag of artifacts, as at the Lockwood site (41HR343; Patterson et al. 1992a; location 3).

The material that has been recovered suggests that the creek was periodically occupied, like most wooded creeks in the Katy Prairie, for a very long time, and there is a cluster of sites stretching for about 15 miles along the eastern part of the creek that contain artifacts dating from the Early Paleoindian Period to the early Historic Period (Figure 8.27B). Like the White Oak and Buffalo Bayou sites, the Cypress sites contain a mixed heritage of points from the Plaeoindian Great Plains, Central Texas Balcones, Trinity-Sabine, and Central Coast-South Texas traditions. Early Paleoindian artifacts were recovered at several of these sites (Patterson et al. 1992a, 1992b). Clovis points were found at the Lockwood site (41HR343; location 3) and at 41HR731. Folsom points and/or Midland points (sometimes called "Folsom without a flute") were found at the Lockwood site as well as at 41HR731 and 41HR624. There were abundant numbers of Early Side-Notched, Dalton, San Patrice, Plainview, Angostura, and Early Stemmed points at the Lockwood site, with lesser numbers at the Owen and other Cypress Creek sites, indicating occupation in both Early and Late Paleoindian periods. The Early and Middle Archaic Periods were well represented at the Owen and other sites with Bell, Carrollton, Bulverde, Wells, and Trinity points, among others. Gary and Kent points were indicative of Middle to Late Archaic periods, as were a few rarer types like Ponchartrain (Louisiana), Shumla (southwest Texas), Refugio (Central and South Texas), and Tortugas (South Texas; Figure 8.28). Late Archaic to Early Ceramic points include Darl, Yarbrough, Ensor, Ellis, and Palmillas. Arrowheads indicative of Late Prehistoric Period include Perdiz, Scallorn, Alba, and Catahoula.

### Dimond Knoll and Evidence of Cross-Cultural Contacts

The Dimond Knoll site (41HR796) lies on the western, upland end of Cypress Creek, just before the last trees are encountered along the (pre-development) creek as it enters the broadest part of western Katy Prairie (location 1 on Figure 8.27). It lies on a low knoll on the north bank of the creek. Initially tested in 2006, it was excavated for TxDOT in 2012 by Coastal Environments Inc. and Moore Archeological Consulting. Final data recovery on a large amount of removed material was done by the Houston Archeological Society (Barrett and Weinstein 2014; Figure 8.29).

The results include perhaps the highest number of artifacts of any site in Texas except the Gault site (Barrett 2018). The Dimond Knoll site, like other Katy Prairie sites, appears to have been visited for millennia by mobile hunter-gatherer groups. Projectile points are represented by Late Paleoindian Period San Patrice, Angostura, Golondrina, and unidentified lanceolate points as well as by younger examples, including most of the Archaic through Late

Figure 8.29. Houston Archeological Society volunteers screen loose soil material excavated by Tx-DOT at the Dimond Knoll site (41HR796) on western Cypress Creek, Harris County, 2013. Photos courtesy of the Houston Archeological Society.

Prehistoric types mentioned in the other Cypress Creek sites. Figure 8.30 illustrates some of the great variety of the 11,500 artifacts found at the site. Of particular interest are some far-travelled exotic points reported by Barrett, including 1) Adena and Florence points from the Adena culture of the Ohio Valley (Late Archaic-Early Woodland Periods); 2) Robbins points from the Adena culture, Early Woodland; 3) Waubesa points from the Hopewell culture, Middle Woodland; 4) Etley from Missouri and Illinois, Late Archaic-Early Woodland; and 5) Motley points from the Mississippi River Valley, Late Archaic-Early Woodland.

The Woodland Period of the Lower Mississippi Valley and its tributaries is time correlative with the latter half of the Late Archaic through most of the Late Prehistoric periods in Southeast Texas terminology (see Figure 7.5 and extended discussion, Chapter 11). These exotic points, all from the interior of the continent, speak to trade routes that reached eastward or northeastward from the Dimond Knoll site (Jason Barrett 2018, and personal communication, 2019). A principal Indian trade route was used by the Spaniard Orobio Basterra and his Indian guides in 1746 and is depicted in Figure 8.27A. It transects the Katy Prairie nearly at the Dimond Knoll site, and heads eastward, ultimately to the Trinity River. To the northwest it links with the terminus of the Bidai Trail (see Figure 4.10, item 12), which heads northeast to other trails and river routes that ultimately stretch to the Ohio Valley (see Atlas V, Frames 9 and 10, plus discussion, Chapter 11). Exotic objects of the same age from the Great Lakes and Ouachitas are found in burials of the nearby Late Archaic Lower Brazos Culture, also discussed in Chapter 11. Clearly, long distance trading routes were locally active by Late Archaic time. These far-travelled exotics as well as the abundance and variety of lithic materials of a wide range of ages at this site speak to the site's continual regional importance.

Unlike the other Cypress Creek sites, there is fairly good preservation of bone

material at Dimond Knoll, including bison and deer bone. Fired clayballs are abundant, including some organized in hearths, as discussed earlier and depicted in Figure 8.21, an excavated hearth at Dimond Knoll. Fired clayballs were also found at most other Cypress Creek sites, including the Owen site as well as sites 41HR366, 340, 992, 991, 629, and 1176. Even though good preservation of bone materials is not present at most of those other sites, the clayballs give evidence of the cooking—most likely of bison, as has been described—that followed hunting.

## Occupation chronology

Even though there is abundant evidence of very long occupation at the Dimond Knoll, Owens, Lockwood, and other Cypress Creek sites, just as at White Oak Bayou and upper Buffalo Bayou tributaries (Figure 8.27B), the evidence does not necessarily suggest a *continuous* occupation. The same sequence of lithic points could result from a series of occasional uses of the creek over the centuries and millennia. A good example of how that could (and probably did) happen can be found at 41HR755, a minor site a few kilometers west of Dimond Knoll, where the creek is not forested (location 5, Figure 8.27). This site was located by Moore Archeological Consulting in 1995, and excavation produced a few chert flakes, some fired clayballs, and a concentration of large flakes that seem to have come from a single chert cobble. Moore's conclusion was that this site was the result of a single ephemeral occupation by a group of hunters who sought game on Katy Prairie (Moore 1995). They cooked their prey and made a few tools, and then moved on. This site is on the extreme fringe of the Cypress Creek cluster of sites, suggesting that those sites in more central positions, where the creek is forested, would have seen many more such ephemeral visits over the millennia, thus yielding the encyclopedic array of points of Early Paleoindian through Late Prehistoric ages.

The cobble that was reduced into flakes at 41HR755 may have come from outcrops of the nearby Willis Formation, or from the Brazos or Colorado River to the

Figure 8.30. A selection of some of the more than 11,500 stone projectile points and other lithic tools recovered at the Dimond Knoll site (41HR796) on western Cypress Creek, Harris County. Unscaled. Courtesy of Houston Archeological Society.

southwest (see Chapter 9). Such cobbles were of high value to groups living farther east along the Trinity and Sabine Rivers, where silicified wood and much smaller chert cobbles are the only available hard material for making points and tools. At the Carl Mehrkam site (41HR365; location 4 in Figure 8.27), not close to any creek, a cache of 50 large stream-rounded chert cobbles was found, many of them with a few flakes removed. No other artifacts were found at that site (Moore 1995). The cobbles were harvested, perhaps from the Brazos or Colorado River, transported to the site, and then cached for later use. The owner never returned to retrieve them.

### Site geography and interpretation of hunting techniques

Although there are no intact bison kill sites along Cypress Creek like those at White Oak Bayou, the artifacts and geography of the Cypress Creek sites demonstrate a similar occupation length and history to those of the Buffalo Bayou tributaries and White Oak. These wooded streams were at least periodically occupied from the Late Pleistocene—when hunters with Clovis and, later, Folsom tools were present—until the early Historic Period. As was mentioned in Chapter 4, the Cypress Creek area contained the last traditional homes of the Akokisa during the early and middle nineteenth century. Although bone preservation at sites is typically poor, there is evidence of both bison and deer at some sites, and of abundant use of fired clayball cookery all along the creek—something that is endemic to the hunting sites of the western Katy and San Bernard prairie sites. The nearly complete absence of fired clayballs in the Trinity and San Jacinto river systems (Figure 8.22) as well as the coastal zone, as well as ethnohistoric accounts of stone and clayball cooking by Plains tribes, suggest that the fired clayballs were mostly used for cooking large game—especially bison—taken in the prairie areas, rather than for smaller game like rabbits, turtles, fish, and deer taken in or near the forest rivers or along the coast.

Like the sites of the Buffalo Bayou tributaries and White Oak Bayou, archeological sites in the Cypress Creek watershed are nearly entirely confined to forested streams, and are not present in the grassland extensions of these streams to the northwest into Katy Prairie. The sites are not all arrayed on one side of the Creek, as at the western Buffalo Bayou area. There is one characteristic that makes Cypress Creek unique among Katy Prairie sites, and that is a series of small intermittent streams that flow from the northwest, emptying into Cypress Creek all along its length (Figure 8.31). Each one of these small secondary streams is forested, making a series of jagged extensions of forest into the prairie to the north of Cypress Creek. Each of these extensions has an adjacent partial enclosure of prairie, enclosed on three or four sides. It is possible that bison and deer were driven or followed into these small enclosures, and then hunted with surround techniques. Processing of game would presumably have needed to take place along Cypress Creek, the only constantly running stream, and that is where campsites are found. However, a game drive where bison or deer are run into the narrow, incised creek bed of Cypress Creek for slaughter—more or less as is demonstrable at White Oak Bayou and inferred at western Buffalo Bayou—is probably a more likely scenario.

Dimond Knoll, by virtue of its abundant lithic artifacts, its exotic, far-travelled

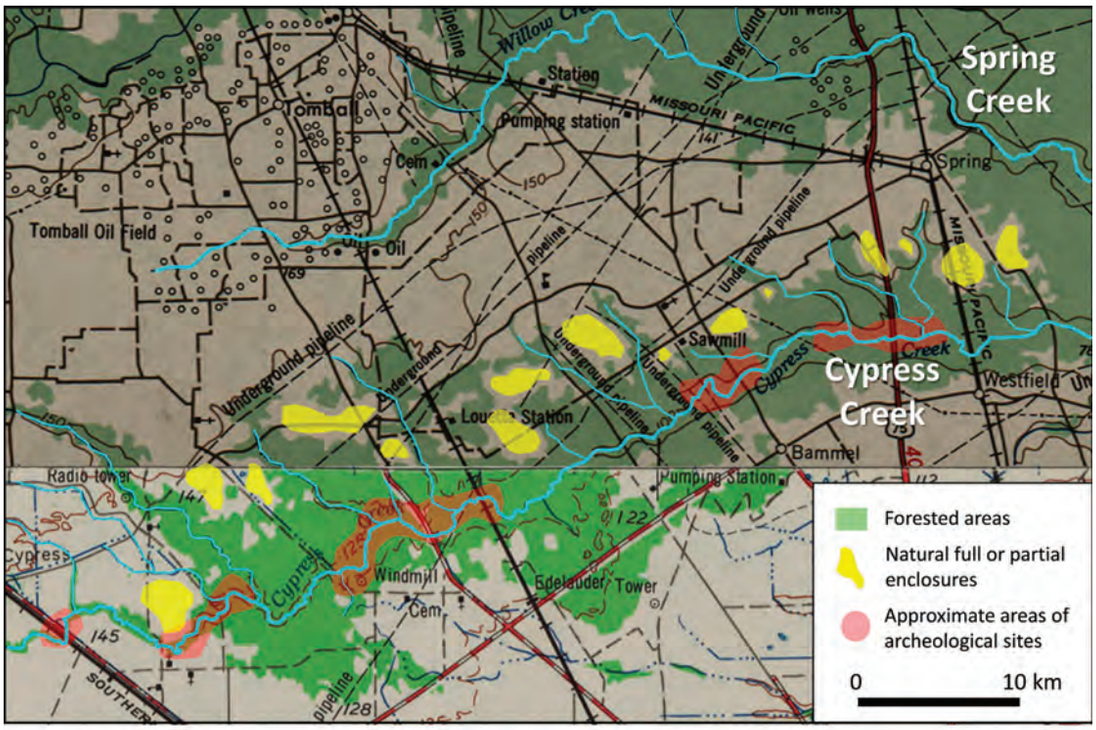



Figure 8.31. Regional topographic maps of Cypress Creek in the 1950s, made by the U.S. Geological Survey before the advent of dense subur-ban development. Areas of natural enclosures partially surrounded by forest are highlighted in yellow, and approximate areas along the creek where archeological sites have been found are highlighted in red shading. Map location shown in Figure 8.27B.

Late Archaic projectile points, and its position on a regional Indian trail, seems to have an importance that goes beyond merely being another hunting campsite on forested Cypress Creek, even one that may have been in a favorable position for trade. The site is at the farthest west extent of riparian forest along the creek; farther to the west, the creek transected open prairie (Figure 8.27B). As discussed earlier, bison appear to have entered the Katy Prairie via a gap between the heavy timber of the East Texas forest and the thick river-bottom forest of the Brazos River. Until the early Historic Period, Native Americans hunted on foot. A western position at Dimond Knoll may have acted as a forward lookout, watching the entry of bison (or perhaps deer herds) into the area. Depending on the vagaries of the positions of the entering herds, Native Americans who gathered and camped at Dimond Knoll could either head north to drive bison into Cypress Creek, or south to drive them into Buffalo Bayou and White Oak Bayou, which would give the occupation of Dimond Knoll a considerable geographic advantage—a sort of conning tower for the prairie, watching incoming herds.

Even deeper into the northwestern Katy Prairie are the early Historic Period winter hunting camps of Akokisa seen by Orobio Basterra in 1746, shown in Figure 8.27A and discussed earlier. These "villages," as the Spanish described them, consisted typical domal stick huts covered by large animal (probably bison) skins, and were situated considerably farther west than Dimond Knoll. Moreover, they were not located along any heavily forested part of Cypress or other creeks. Why, one might ask? A major difference in Akokisa hunting came with the acquisition of horses; these people possessed horses certainly by 1718, when Bellisle noted their use on the Katy Prairie by Akokisa on horseback who hunted bison with bows and

arrows. With the use of the horse and with more efficient bows and arrows, Akokisa were freed from having to run on foot to drive bison into geographic kill zones like stream beds, and could now ride up close to bison to shoot them on the open prairie, a practice that was not only observed by Bellisle but also commonly observed of all Plains tribes in historic times. This meant that by the early Historic Period the most efficient place to hunt bison was deep into western Katy Prairie, near the entry point for seasonally moving bison herds, where they (presumably) entered the Katy Prairie in the late fall and early winter looking for green grass.

## San Bernard Prairie archeological sites

The San Bernard Prairie occupies the high prairie in between the formerly forested floodplains of the Brazos and Colorado rivers, primarily in Wharton County (Figure 8.2). Principal towns in the area are Wharton to the south, Eagle Lake on the west, and Wallis at the north. This prairie and its surrounding area were the locations of a remarkable series of archeological investigations at 32 sites by the Houston Archeological Society (HAS) in the 1980s and 1990s, led by local landowner and avocational archeologist Joe Hudgins as well as by the then chair of HAS, Leland Patterson.

As in the Katy Prairie, there are a number of excavated sites along the small waterways of the area, which include the San Bernard River, West Bernard Creek, and Peach Creek (Figure 8.32). The latter two creeks both flow into the San Bernard River, forming two V-shaped confluences that are lined with archeological sites and appear to have been the primary location of Native American occupation in the

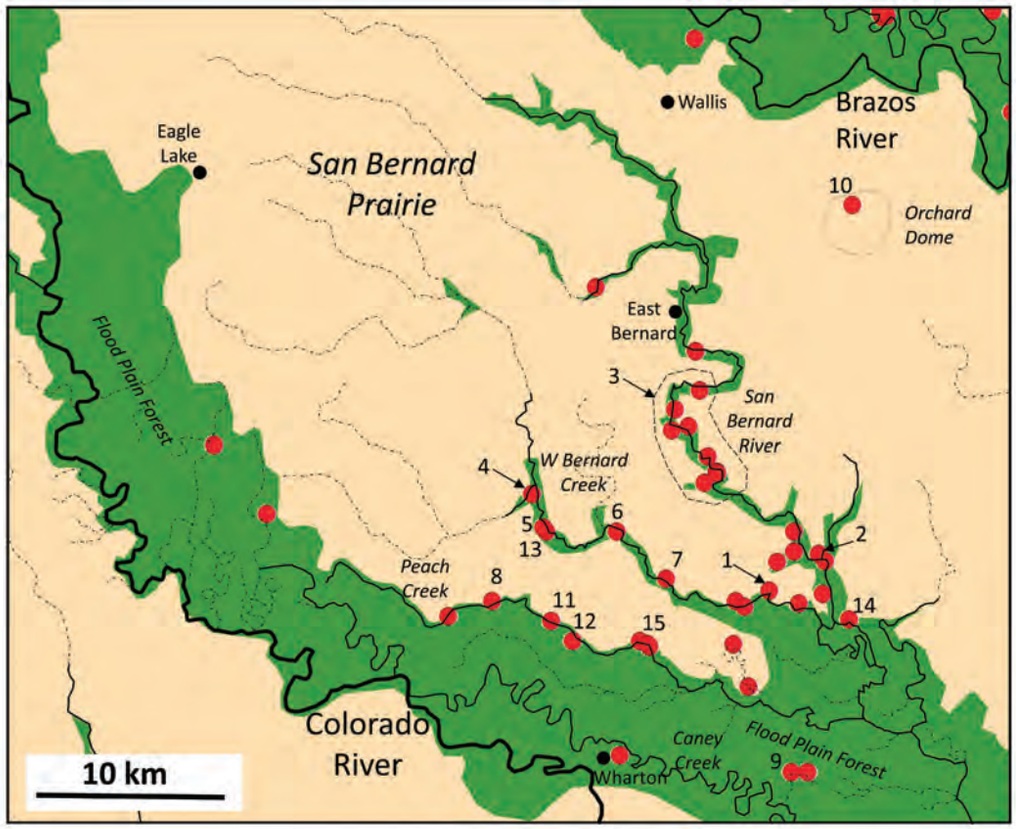



Figure 8.32. Map of surface features and principal published archeologi-cal sites of the San Bernard Prairie, Wharton and Fort Bend counties. See figure 8.9 for map location. Principal archeological site locations:

1. 41WH19
2. Ferguson site, 41WH42
3. Area of freshwater shellfish that helped preserve faunal remains
4. Piekert site, 41WH14
5. 41WH26
6. 41WH2
7. 41WH7
8. 41WH10
9. Caney Creek nutting sites, 41FB83 & 32
10. Orchard Dome, 41FB249
11. Shanklin site, 41WH8
12. 41WH5
13. Post San Bernard site, 41WH16
14. 41FB28

area. It is of interest to note where archeological sites have *not* (yet) been found in this area:

1) Along unforested extensions of these same three small waterways, where they extend into the former San Bernard tallgrass prairie.

2) Along Caney Creek, another small creek that inhabits the low floodplain of the Colorado River. There are two small sites on that creek (41WH83 and 41WH32; location 9 on Figure 8.32) containing a few marine shell ornaments and other artifacts in what appear to have been short-term-occupation fall nutting sites in a native pecan and hardwood forest along the low creek. The marine shells suggest that these were coastal people, which hearkens back to Cabeza de Vaca's reference to inland fall pecan-gathering trips by coastal Texas Native Americans (Hudgins 1998). Other than these sites, little else has been found on Caney Creek, which—being located far within the forested floodplain—would not have been an attractive place to drive or otherwise hunt bison.

3) Along the Colorado River. There are Holocene fluvial deposits along the river that would have buried any Paleoindian sites (see discussion, Chapter 5), but even younger sites are seemingly missing. It could be that periodic violent floods have washed them away. It could also be that, like Caney Creek, the Colorado River was here too far away from the San Bernard Prairie, lying

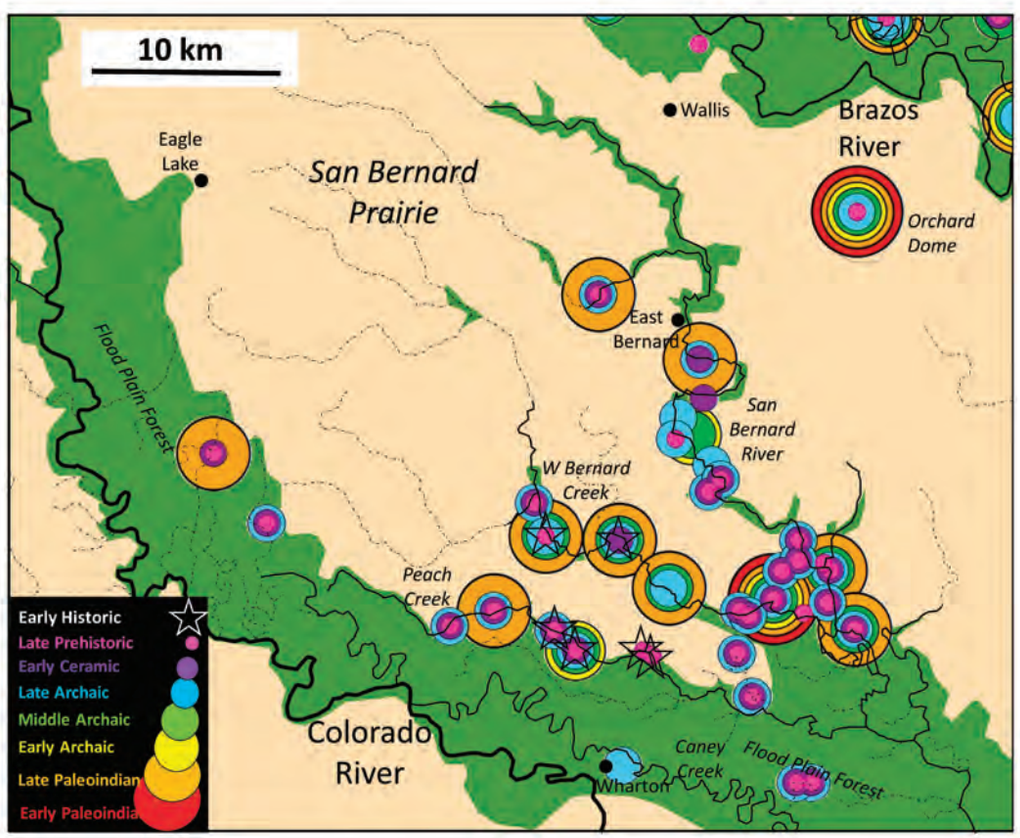



Figure 8.33. Map of the San Bernard Prairie, Wharton and Fort Bend Counties, showing archeologic periods represented at sites, from projectile point chronology. Area same as in preceding figure.

within a broad, thick forest, and thus not a good location for driving large prairie game.

It would appear from this geography, then, that Native Americans preferred forested small creeks, especially near V-shaped branches that open to the northwest; this is the same pattern as on the Katy Prairie. This suggests that the V-shaped intersections formed natural cul-de-sacs that could be used in hunting bison, as suggested in Figure 8.4.

## Occupation chronology

This area, like Katy Prairie, had a very long occupation history, exhibiting what Dillehay has called niche consistency: "the continuous mapping onto, exploitation of, movement through, or settling into familiar environments" (Dillehay 2019). Figure 8.33 displays a significant number of long-occupied sites, some of which extend into the early Historic Period. A favorable geographic and ecological environment allowed Native Americans to return time and time again to the same places, using the geography and ecological environment in a repeatable way.

Two Clovis points found at Orchard Dome (41FB249; location 10 in Figure 8.32), a Folsom point recovered at 41WH19 (location 1), and Plainview points from 41WH19, 41WH10, 41WH26, 41WH7, and 41FB249 (Locations 1, 8, 5, 7, 10, respectively) establish an Early Paleoindian presence of hunter-gatherers (see Figure 8.32 for site locations). A proboscidean bone recovered at 41WH19 in the lowest stratigraphic level, beneath the level where the Folsom point was found (Patterson et al. 1987), suggests that the earliest occupation may have been related to Late Pleistocene megafauna hunting, coeval with the Clovis points found at nearby Orchard Dome (Patterson 1997).

The San Bernard Prairie was also the site of very young occupations in the Historic Period, of the Coco band of the Karankawa Indians (see Chapter 4). Six sites contain material demonstrating occupation at this time, as marked by star symbols on Figure 8.33. These include shaped glass tools (typically scrapers; see Figure 8.34) at four sites, and Historic Period Cuney and/or Guerrero arrow points (Figure 8.35) at three: the Shanklin site (41WH8; location 11 in Figure 8.32), 41WH5 (location 12), and 41WH2 (location 6). Guerrero points are known from Spanish mission-era Indian sites in central Texas, and a Spanish coin was found at the Shanklin site (41WH8). The Shanklin site may have been the dwelling place of Cocos at the time of the Gilleland massacre of 1833; a farmer of that name who lived just south of modern Wharton (see map, Figure 4.22) was threatened by hungry "Karankawa" (probably Coco), and the settlers took reprisals at the Indian camp nearby. The site also included a metal projectile point fashioned from a key escutcheon (Figure 8.36; Hudgins 1982, 1986). Site 41WH16 (location 13) was the site of Post West Bernard, active only from 1837 to 1839, just after the war with the Karankawa-Coco had effectively ceased. A Native American site at that location yielded Historic Period Cuney and Guerrero points (Hudgins 1985). The last known sightings of Coco living in this prairie area were in the 1870s, when small remnant groups of "fish-eater" Indians were seen begging in the area by Hudgins's grandfather (Hudgins 1986).

Figure 8.34. Glass scraper from 41WH2, West Bernard Creek, Wharton County, evidence of Early Historic period occupation of the site. From Patterson, 1980; image courtesy of the Houston Archeological Society.

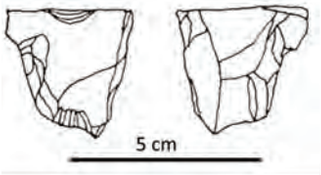
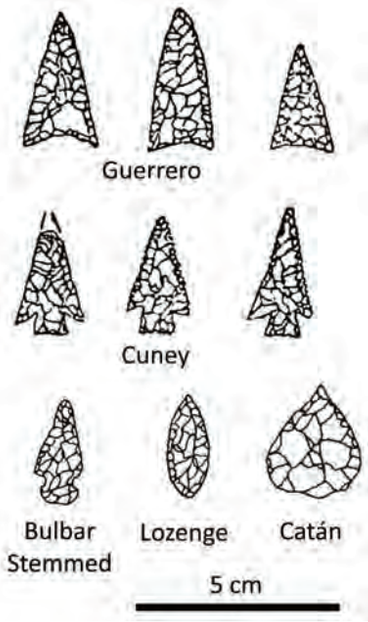



Figure 8.35. Late Prehistoric to Historic period arrow and dart points from the Peach Creek area. Guerrero and Cuney points are from the Shanklin site (41WH8), and the Bulbar Stemmed and Lozenge points are from 41WH40. The Catán point is from 41WH12. Guerrero points are commonly found at South Texas Spanish mission sites. The Lozenge and Catán points are commonly found along the central coast, sug-gesting that they were brought into what was most likely a Coco site by another Karankawa group. Images from Hudgins 1980, 1986, courtesy of the Houston Archeological Society.



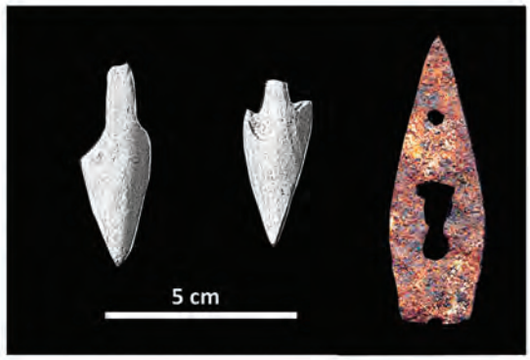



Figure 8.36. Unusual projectile points from the Late Prehistoric through early Historic Period Shanklin site, 41WH8. Left, two bone points. Along with marine shell beads found at the site, the bone points suggest that the occupants were from the coastal area, where lithic material is scarce. Right, iron point made from a (probably Spanish) iron escutcheon, Historic Period. From Hutchins, 1986; image courtesy of the Houston Archeological Society.

## A cultural crossroads

Of all parts of Southeast Texas, the San Bernard Prairie seems to have been the most regionally cosmopolitan. Several types of information establish the area as a long-term cultural crossroads, including: regional distributions of projectile points, distribution of ceramic types, a record of violent deaths at mortuary sites, and ethnohistorical accounts from the early Historic Period.

**Projectile Point Traditions.** All of the four traditions that were introduced in Chapter 7 and illustrated in Atlas II are represented in the San Bernard Prairie, just as they are in the adjacent Katy Prairie. Beginning with the Late Paleoindian Period, both the Plainview and Angostura points of the Paleoindian Great Plains Tradition are present (Atlas II, Frames 6 and 8). The distribution of each point style shows a prominent extension stretching along the Colorado River reaching as far east as the San Bernard Prairie (and also the Katy Prairie). As was discussed in Chapter 7, these points are broadly indicative of bison hunting culture on the southern Great Plains, which suggests (along with other data discussed below) that the San Bernard Prairie was at the southeastern fringe of that activity.

The Central Texas Balcones Tradition (CTBT) is well represented in the San Bernard. Points data show an apparent lull in activity in the San Bernard Prairie during the Early Archaic (see chronology, Figure 7.3). Neither of the Early Archaic Uvalde and Martindale points of the CTBT reach as far east as the San Bernard (Atlas II, Frames 10 and 11), but when moist conditions returned at the end of that period and into the Middle Archaic, so must have the bison. Bison hunters from Central Texas Balcones Tradition are represented by Middle Archaic Bell and Andice, Travis, and Wells points (Atlas II, Frames 12–14) that show the same sort of extension of their distribution reaching southeastward from the Balcones along the Colorado River to an endpoint in the San Bernard as did the earlier Plainview and Angostura. The Bell, Travis, and Wells points are associated with bison hunting (Collins et al. 2011). The Late Archaic Pedernales and Fairland points (Frames 15 and 17) are examples of the same sorts of hunting forays into the San Bernard and Katy prairies. Ten Pedernales points were found at 41WH2 (Patterson and Hudgins 1980; location 6 on Figure 8.32). One of the ten Pedernales points found at this site is made of central Texas chert, but others appear to have been made from Colorado River cobbles, indicating perhaps that the hunters were working along the Colorado River for an extended length of time. Other central Texas materials found at 41WH2 include two pieces of crystal quartz and a piece of galena, ostensibly from the Llano Uplift. The Fairland point extends into the Southeast Texas project area effectively only in the San Bernard Prairie. Late Prehistoric Edwards arrow points (Frame 18) are evidence of of CTBT hunters in the area when bow and arrow technology arrived.

There is a long record of the presence of Trinity-Sabine Tradition (TST) hunters on the San Bernard Prairie. Beginning late in the Paleoindian Period, San Patrice points are prominently found in both the San Bernard and Katy Prairies (Frame

21). They are more prominently associated with sites along the Trinity and other East Texas rivers, and their existence on the San Bernard and Katy prairies seems to indicate hunting forays, as discussed in Chapter 7. As with the Central Texas Balcones Tradition, there are few examples of Early Archaic points of the TST on the prairies. In the late Early Archaic and Middle Archaic periods, with the resumption of a more moist climate, Carrollton and Trinity points (Frames 22 and 23) are present on the prairies in addition to their more usual haunts in the Trinity River bottomlands. Some of these prairie points are found in sites with bison remains, as is discussed below. Late Archaic to Early Ceramic Gary and Kent points are heavily represented in the San Bernard and Katy prairies (Atlas II, Frames 25 and 26), as are Yarbrough points (Frame 27). Late Prehistoric Alba (Frame 29) and Catahoula (Frame 28) arrow points of the TST are also found in the San Bernard.

The Central Coast-South Texas Tradition (CCSTT) arrived later to this area than the Central Texas Balcones and Trinity-Sabine traditions. It is first represented by the Late Archaic Refugio (Frame 32) and Morhiss points (Frame 33). The San Bernard and Katy prairies mark the northeasternmost range of these points, suggesting that Central Coast hunters were making a prairie hunting foray here. Later CCSTT connections are indicated by Late Prehistoric Lozenge points from the central Texas coastline (Baffin Bay to Corpus Christi Bay), and Catán points from southernmost Texas and northeastern Mexico (Frame 34; Atlas II; Turner et al. 2011). These latter two point styles were found at sites on Peach Creek, at 41WH40 and 41WH12 (Patterson and Hudgins 1989a, 1989b). A number of bone arrowheads were found at 41WH8 (Figure 8.36), in a site that contained 8,000 Rockport ceramic sherds, as discussed later. Bone projectile points are more prevalent on the coast, where lithic material is not available, and the association with Rockport ceramics indicates that the owners may well have been proto-Karankawans. Early Historic Period Guerrero points of the Central Coast-South Texas (Frame 35, Atlas II; and Figure 8.35) are associated with South Texas mission Indians, including the Karankawa and Coco, and are found at two sites in the San Bernard Prairie (41WH10 and 41WH16). In the early Historic Period, the Coco were the northeasternmost band of the Central Coast-South Texas Tradition Karankawa.

**Mortuary culture and records of violent deaths.** During the Late Archaic Period a very unusual culture blossomed along that part of the Lower Brazos separating the San Bernard and Katy prairies, here named the Lower Brazos (material) Culture for the people buried in a group of cemeteries along the Brazos rim, and discussed in more detail in Chapter 11. Projectile point and ceramic data suggest that this culture was most closely aligned with the Central Coast-South Texas Tradition. These people used marine shell ornamental pendants and gorgets made of lightning whelks (*Busycon perversum*) from the coast. Shell tools found in nearby Brazos valley sites show they were making those ornaments here, and so it is thought that they were a coastal group, probably from Matagorda County, much like the Coco of the early Historic Period, who also hunted in the San Bernard Prairie. All was not peaceful with people of other traditions using the prairie, as their cemeteries contain evidence of a number of Late Archaic violent deaths (Hudgins and Kindall 1984; Patterson et al. 1993b). Three burials contained imbedded Central Texas Balcones Tradition Fairland and Bulverde points. Three other burials contained Gary, Kent,

and Yarbrough points of the Trinity-Sabine Tradition, suggesting inter-group conflict (Hall 1981). This material culture has a fascinating story told in some detail in Chapter 11, but for now suffice it to say that the people of the Late Archaic Lower Brazos Culture appear to be representative of the Central Coast-South Texas Tradition.

**Ceramics.** Slightly later than the above-mentioned mortuary complex, ceramics arrived at the San Bernard and Katy prairies, allowing another look at cross-cultural relationships in the San Bernard Prairie. The Ceramic through early Historic Period ceramics of the project area are shown in Figure 8.37, along with the early Historic Period cultural group and tradition boundaries. Goose Creek, an untempered sandy paste pottery, as well as San Jacinto pottery, a slightly later tempered ware otherwise similar to Goose Creek, are attributed to the so-called "Mossy Grove" culture of Early Ceramic and Late Prehistoric (and locally, Historic) periods (Story 1990; Aten 1983; see Chapter 11 for discussion). Both were associated with the Atakapa during the early Historic Period, including the Akokisa and Bidai bands; these groups were modern heirs of the TST. Goose Creek pottery is found throughout western Atakapa territory in the San Jacinto River drainage basin, but as the map shows, it is also present in the San Bernard Prairie and along the Matagorda County coast in what was Coco territory in the early Historic Period. The Cocos were a Karankawan culture and modern heirs to the Central Coast-South Texas Tradition. Many sites in the San Bernard Prairie also include sherds of Rockport ware, a Late Prehistoric pottery type with asphalt decorations that has strong associations with the Karankawa (Ricklis 1995, 1996). These sites include the Shanklin site (41WH8) as well as 41WH12 and 41WH16 (see Figure 8.32 for locations). Figure 8.38 displays

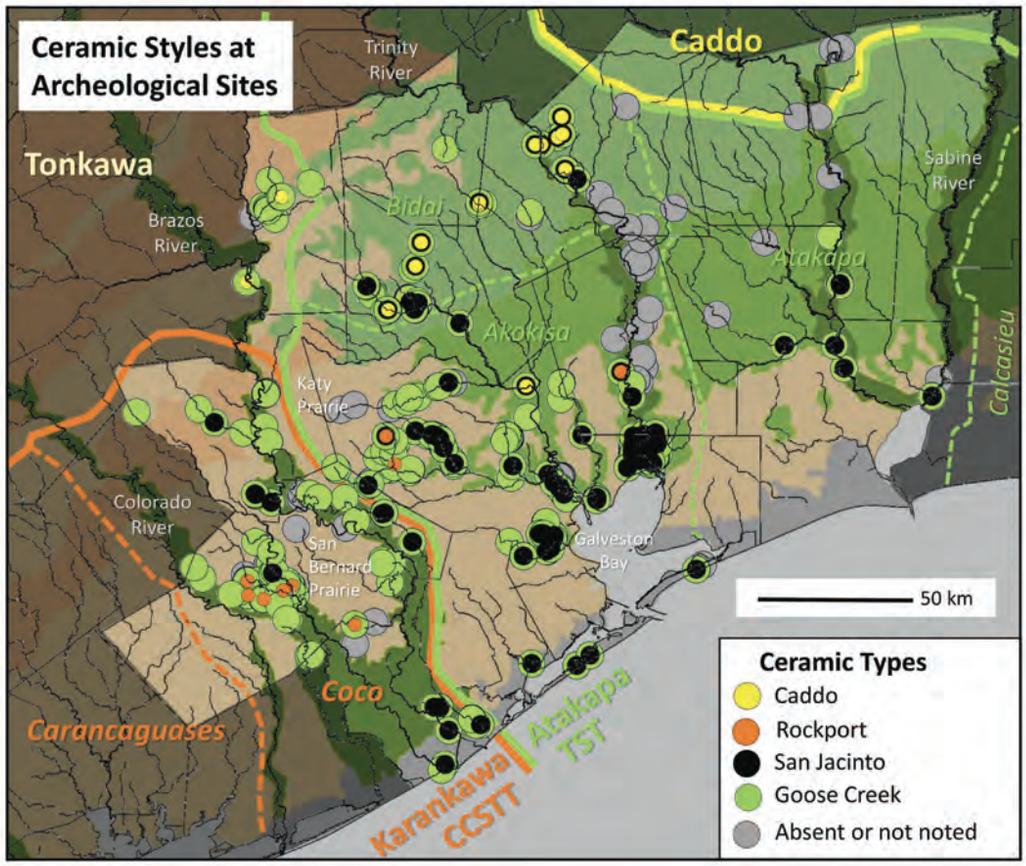



Figure 8.37. Geographic distribution of ceramics in project area archeolog-ical sites from ca. AD 100+ to ca. AD 1800. Heavy lines show boundaries of cultural groups (tribes) from the early Historic Period (ca. 1700), as depicted by Swanton 1952. Dashed lines show inferred boundaries of individual bands. Abbreviations: CCSTT=Central Coast-South Texas Tradition; TST=Trinity-Sabine Tradition.

some of the asphalt-decorated sherds found at Shanklin.

Most sites in the San Bernard prairie have only a relatively few Goose Creek sherds. The big pottery-making areas of the Trinity-Sabine Tradition appear to have been along the coast surrounding Galveston Bay (Figure 5.3), supporting the idea that TST hunters were in the San Bernard for seasonal, short term visits. The largest number of Goose Creek sherds was found at site 41WH12 on the San Bernard River (637 sherds; Patterson et al 1993b). However, at the Shanklin site (41WH8) on Peach Creek, a much larger number of about 8,000 sherds were excavated, most of them proto-Karankawan Rockport ware (Hudgins 1982). The proto-Coco were closer to their coastal home ground than were TST hunters.

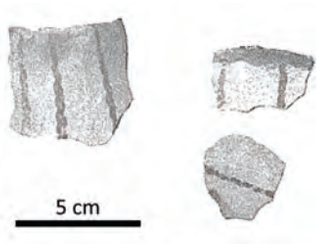



Figure 8.38. Asphaltum-decorated ceramic sherds of the Rockport phase, from the Shanklin site (41WH8), Wharton County. From Hudgins (1986); image courtesy of the Houston Archeological Society.

**Ethnohistoric accounts.** It is perhaps easiest to conclude from projectile point data, mortuary data and ceramic distribution that these various traditions roamed separately through the San Bernard prairie during seasonal hunts, occasionally coming into conflict with each other, but there are other possibilities suggested by ethnohistorical accounts. These accounts note that both Akokisa and Karankawa members tended to marry outside their bands, which would facilitate the multi-ceramic pattern noted in the San Bernard area. Moreover, the San Bernard Prairie's Coco Indians were an unusual group, as mentioned in Chapter 4. Known to speak Karankawan and assumed to be the easternmost tribe of that cultural group, nonetheless when given the chance to join a Spanish-era mission they chose to cohabit with Bidai and Akokisa; the rest of the Karankawa mostly eschewed mission life. At a site in the Katy Prairie in 1772, Spanish Captain Don Luis Cazorla found the Coco in a communal hunt with both Karankawa and Jaraname (CCSTT) from the central and south Texas coast as well as (TST) Bidai from the Trinity River (Woodrick and Linton 2009). At the Melon site in Refugio County to the southwest (41RF21), mixed Rockport and Toyah pottery sherds along with prevalent bison bones suggested to Ricklis (1996) that those two ethnic groups (one from the CCSTT, the other presumably CTBT) were getting together for communal hunting. Father Massanet, traveling with Governor Domingo Terán in 1690, noted that Indian groups from as far west as West Texas, south to the Rio Grande Valley, and east to Caddo lands of the Pineywoods would meet for a large rendezvous or trade fair near San Marcos and to hunt cooperatively in the autumn, returning home in winter (Foster 1995:58). In spite of periodic conflict—for example, the warfare between the coastal Akokisa and the inland Plains "Toyal" on the Katy Prairie, as experienced by Bellisle and mentioned earlier—people of different groups moved around and were sometimes found in interesting company far from home.

## Hunting cultures at the Prairie Grove sites

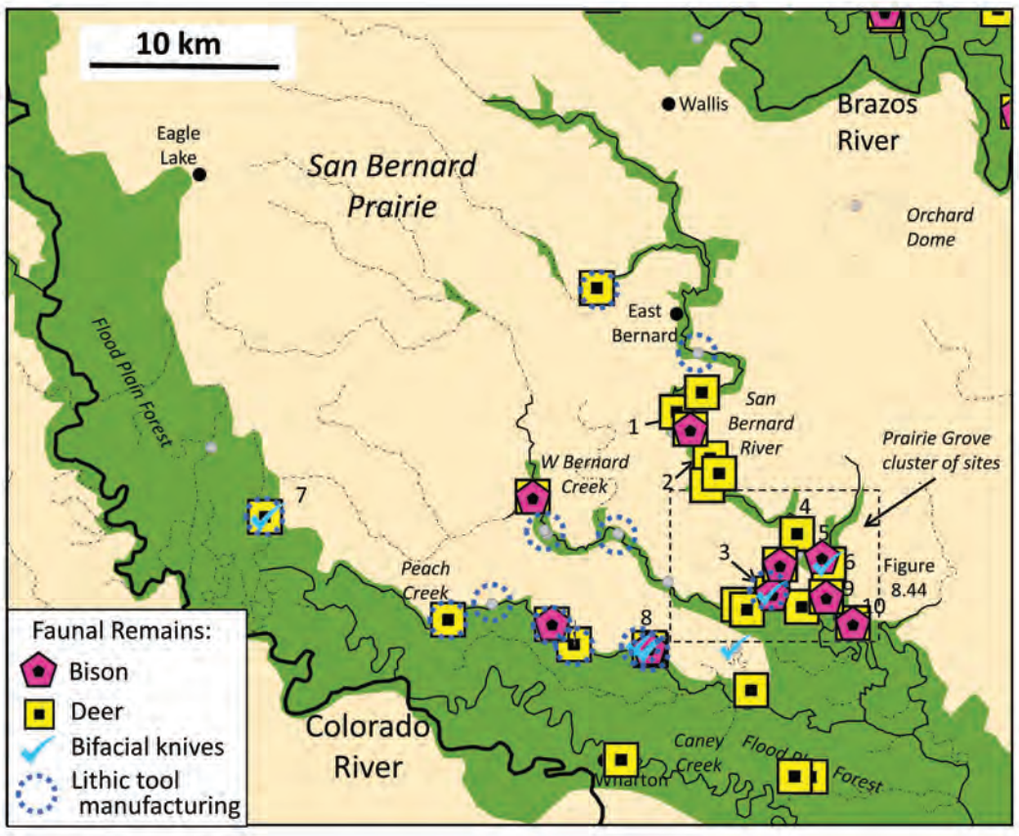
There is a prominent cluster of archeological sites at the intersection of the San Bernard River and West Bernard Creek (Figure 8.39, within the dashed rectangle). This cluster of sites is here named for the Prairie Grove church and community, a few miles east of Hungerford, Texas. Archeological data from these sites help illuminate the nature of this part of the San Bernard prairie as a hunting area, and the landscape of that vicinity helps illuminate the hunting techniques used by Native American groups there.

Figure 8.39. Map of the San Bernard Prairie, Wharton and Fort Bend coun-ties, showing sites containing remains of deer and bison as well as lithic tool manufacturing sites. Area shown is the same as in Figure 8.32. Locations mentioned in text:

1. Cluster of three sites, 41FB34, 41FB37, 41WH44
2. 41FB32
3. 41WH19
4. 41WH21
5. 41FB43
6. 41FB42
7. 41WH65
8. Cluster of three sites, 41WH40, 41WH74, 41WH12
9. 41FB36
10. 41FB28

Figure 8.39 highlights the distribution of sites where bison and deer bones have been recovered in San Bernard Prairie sites. Deer are found at most sites in the San Bernard Prairie, as they are in the Katy Prairie and, for that matter, much of Southeast Texas. In sites with well-stratified deposits, such as 41WH19 on West Bernard Creek and 41FB34 on the San Bernard River, deer bone is scattered throughout all levels. Bison remains, on the other hand, are slightly more focused geographically and appear primarily at sites in the Prairie Grove cluster of sites, in a cul-de-sac where the West Bernard Creek joins the San Bernard River.

The sites with bison bones at Prairie Grove correlate well with the sites with large numbers of fired clayballs, as shown in Figure 8.40. Six sites in the Prairie Grove cluster contain more than 1,000 clayballs each. An example of the correlation between high amounts of clayballs and presence of otherwise scarce bison bones is 41WH19, a well-stratified site that was excavated by the Houston Archeological Society in 1987 (Patterson and Hudgins 1985, Patterson et al. 1987; location 3 on Figure 8.40). At that site, a total of 4,397 fired clayballs were found, distributed in all of the four levels excavated, indicating that the hunters who occupied this site were familiar with clayball cookery from Folsom time to the dawn of the Historic Period. Five hearths were found, in the Archaic through Late Prehistoric levels of the deposit; these were associated with in situ large concentrations of fired clayballs indicative of cooking use. Bits of charcoal were found throughout the excavation, and one at a young stratigraphic level was dated at AD 1585 in the early Historic Period.



A photograph of the 3 m thick stratigraphic section exposed during excavation of that site is shown in Figure 8.41, where the principal archeologist of most of the Wharton site studies, Joe Hudgins. is shown standing upon the Late Pleistocene Beaumont Formation that underlies the layers of the occupied site. That site's projectile artifacts indicate a long occupation extending from the Early Paleoindian period (Folsom), Late Paleoindian (including San Patrice, Plainview, and Scottsbluff), Early and Middle Archaic (Carrollton), Late Archaic and Early Ceramic (Bulverde, Travis, Marcos, Williams, Kent, Gary, Yarbrough, Palmillas, Morhiss, and Ellis), and Late Prehistoric (Scallorn, Edwards, Perdiz). This list indicates a very long history of Central Texas Balcones Tradition groups alternating with (or interacting with) Trinity-Sabine Tradition groups and— based on the presence of significant amounts of Rockport ceramics—Central Coast-South Texas Tradition hunters like the modern Coco and Karankawa. There are bison bones present at all levels of the 41WH19 site except the earliest (Early Paleoindian). Deer bones are present at all levels. There is a reported rapid drop in the frequency of bone of all types encountered with depth and with increasing age in the sequence, attributed to degradation (dissolution) of bone with time.

The incidence of bison bone in the Katy and San Bernard prairies (Figure 8.1) and the high numbers of fired clayballs there (Figure 8.22) suggest a possible link between the two, as mentioned earlier. In the area surrounding Galveston Bay – associated with the Trinity-Sabine Tradition and the Atakapa of the early Historic Period – bison bones are also present, but fired clayballs are not prominent. This

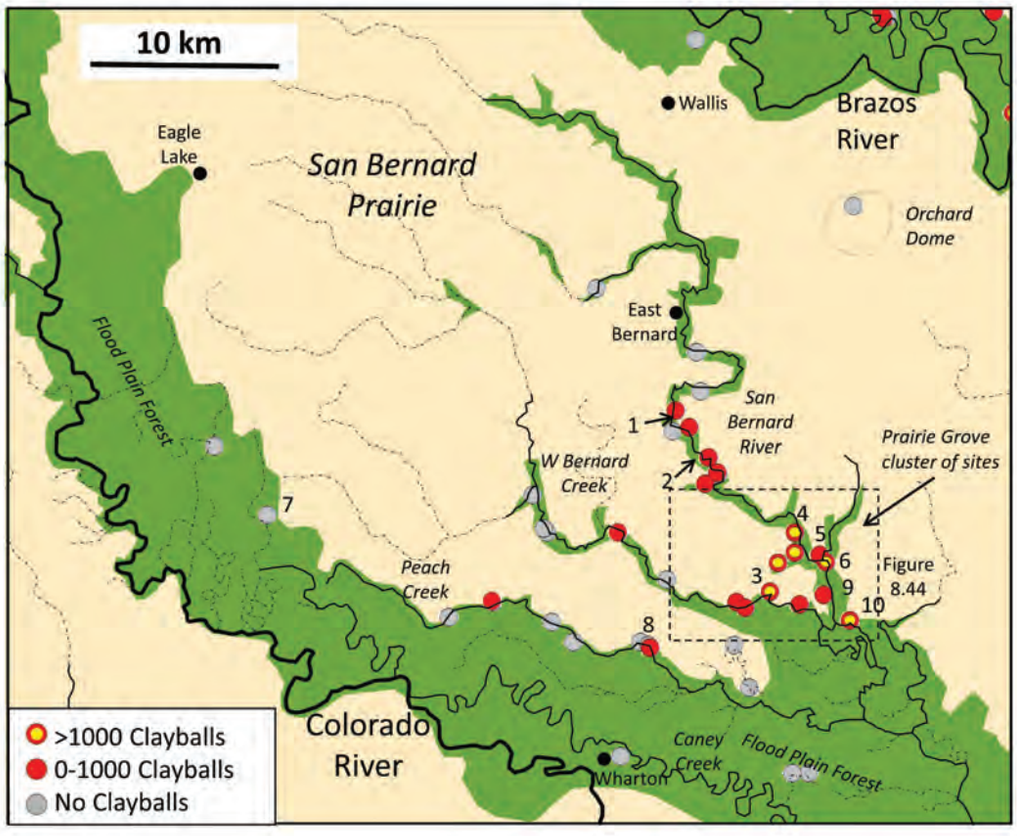



Figure 8.40. Map of the San Bernard Prairie, Wharton and Fort Bend counties, showing sites containing fired clayballs. Numbered site locations are as listed in Figure 8.41.

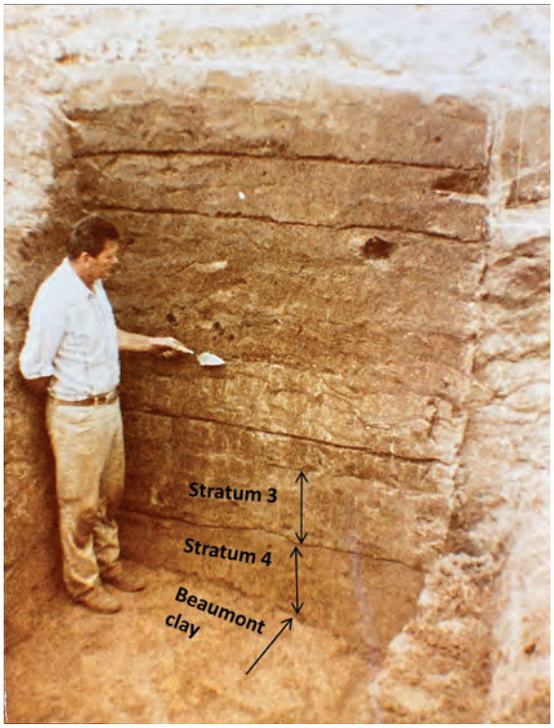



Figure 8.41. The stratigraphic se-quence at site 41WH19, San Bernard Prairie, as photographed during excavation in 1988; Joe Hudgins is holding the trowel. He stands on pre-occupation Pleistocene Beaumont clay. Stratum 4 contains Early Paleoindian artifacts and is overlain by Late Paleoindian Stratum 3. Image courtesy of Joe Hudgins.

suggests that the Atakapa may not have used fired clayball cookery to the extent used by the CTBT. Collins (2011) notes that heated stone boiling cookery existed in Central Texas in Archaic time, and that as already discussed, people of probable Plains affiliation were using both heated stones and clayballs at sites along the Colorado River, to the immediate west of the San Bernard Prairie. The presence of fired clayballs in the San Bernard and Katy prairies, but the general absence of them in the area surrounding Galveston Bay as well as in the eastern Texas forest, suggests that the use of clayballs may well have been cultural and connected mainly to Central Texas groups in this region.

**Lithic tools for butchering.** The butchering of bison was facilitated with larger than normal tools. The bifacial knife is associated with bison (Patterson 2005b); a knife of this type was found adjacent to a bison bone in nearby Waller County (41WL27; Patterson et al. 2005). Figure 8.39 highlights sites where bifacial knives have been recovered, and there is a rough correlation with the presence of bison material in the area. Also shown on that figure are places where primary reduction of cobbles and/or the manufacturing of large tools like the biface have occurred. Chert cobbles required in making big knives are found nearby in the Colorado River, above Wharton, extending into central Texas (see Chapter 9), and so most of these sites are found along the edge of the Colorado River valley. In sites farther afield in the prairie, cobbles and evidence of primary reduction are typically lacking, as cobbles would have had to be brought on site. In these cases, either fully fashioned knives or preforms that have already had much of their bulk removed would have been brought in. A Late Prehistoric and Historic Period site near the Colorado River at 41WH40 (location 8) is typical of these manufacturing sites (Patterson and Hudgins 1989b). Unfinished bifaces were found there, along with chert cobbles from the nearby Colorado. Examples of finished bifaces are found at the abovementioned 41WH19 (Figure 8.43) and 41WH65 (Figure 8.42C); both are a short distance up the Colorado River valley from 41WH40 (Figure 8.39). The large bifacial knife from 41WH19 is made of Central Texas Edwards chert (Figure 8.43, top) and is placed in the Late Prehistoric by Patterson (2005a).

A number of unusual "butted biface" cutting tools, worked on only one end of a thin cobble, were recovered at 41WH12 on Peach Creek (Figure 8.42, items D and E; Patterson and Hudgins 1989a). These are typically Late Archaic tools known mainly in central and south-central Texas (Turner and Hester 1985) and have more recently been elegantly re-christened "Kerrville" bifaces (Turner et al. 2011). Another Central Texas cutting tool found in the San Bernard is the corner tang knife, a fragment of which was found at 41WH19 on West Bernard Creek (location 1, Figure 8.32; Patterson and Hudgins 1989a); a drawing of a similar one from the nearby Bowser site is shown in Figure 8.42, item F. Corner tang knives are strongly associated with Late Archaic Great Plains bison-hunting cultures, as discussed in Chapter 11 and delineated on Frame 1 of Atlas V; also see Patterson, 1937).

## Interpreted hunting techniques

Bison and clayball-laden site 41WH19 is but one in a series of bison-related sites that occur at the Prairie Grove cluster, in the funnel-shaped cul-de-sac formed by the intersection of the San Bernard River and West Bernard Creek (Figures 8.39 and 8.40). This cul-de-sac was a place much valued for hunting for a long period of time, as evidenced by occupational chronology data (Figure 8.33).

Within the Prairie Grove cul-de-sac, the Middle Archaic through Late Prehistoric Kolojaco site on the San Bernard River (41WH21, location 4, Figure 8.39), contained deer, turtle and fish bones but no bison bones were found. However, bison remains were found in adjacent Late Prehistoric site 41FB43 (Location 5; Patterson et al. 1996; Patterson and Hudgins 1989c). Bones at the Kojolaco site were mostly burned, suggesting that burning made them more resistant to decay. Over 7,000 clayballs were found at that site, at all levels in the excavation. Also close by, the Ferguson site (41FB42; location 6; Patterson et al. 1993b) contained 15,188 fired clayballs at all levels in the site from Late Paleoindian through Late Prehistoric, but no bison bones. Two smaller sites immediately to the south contained bison remains: 41FB36 and 41FB28 (locations 9 and 10). The latter site, of Early Archaic through Late Paleoindian age, contained 5,350 clayballs distributed through all levels of the excavation as well as poorly preserved deer, bison, and turtle remains (Patterson et al. 2006).

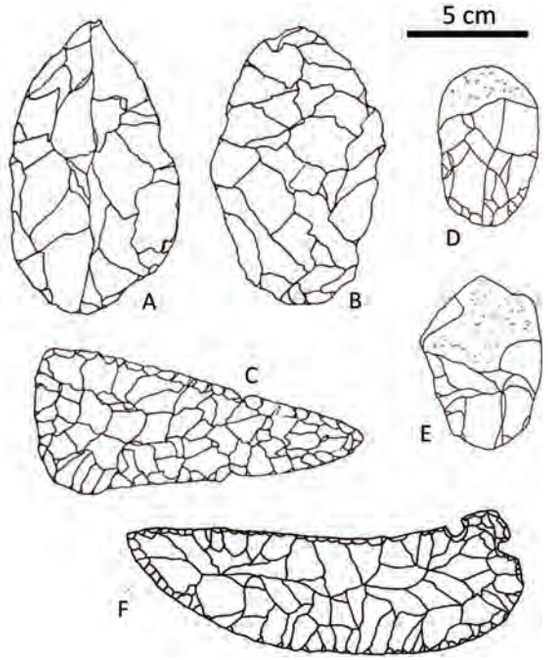
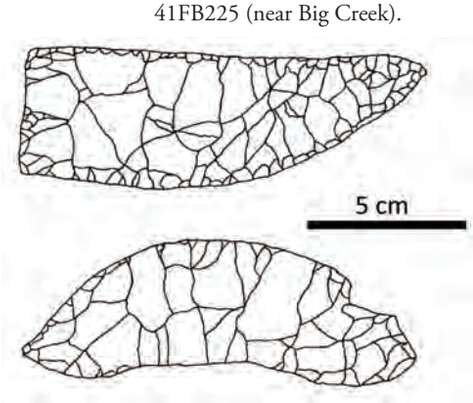


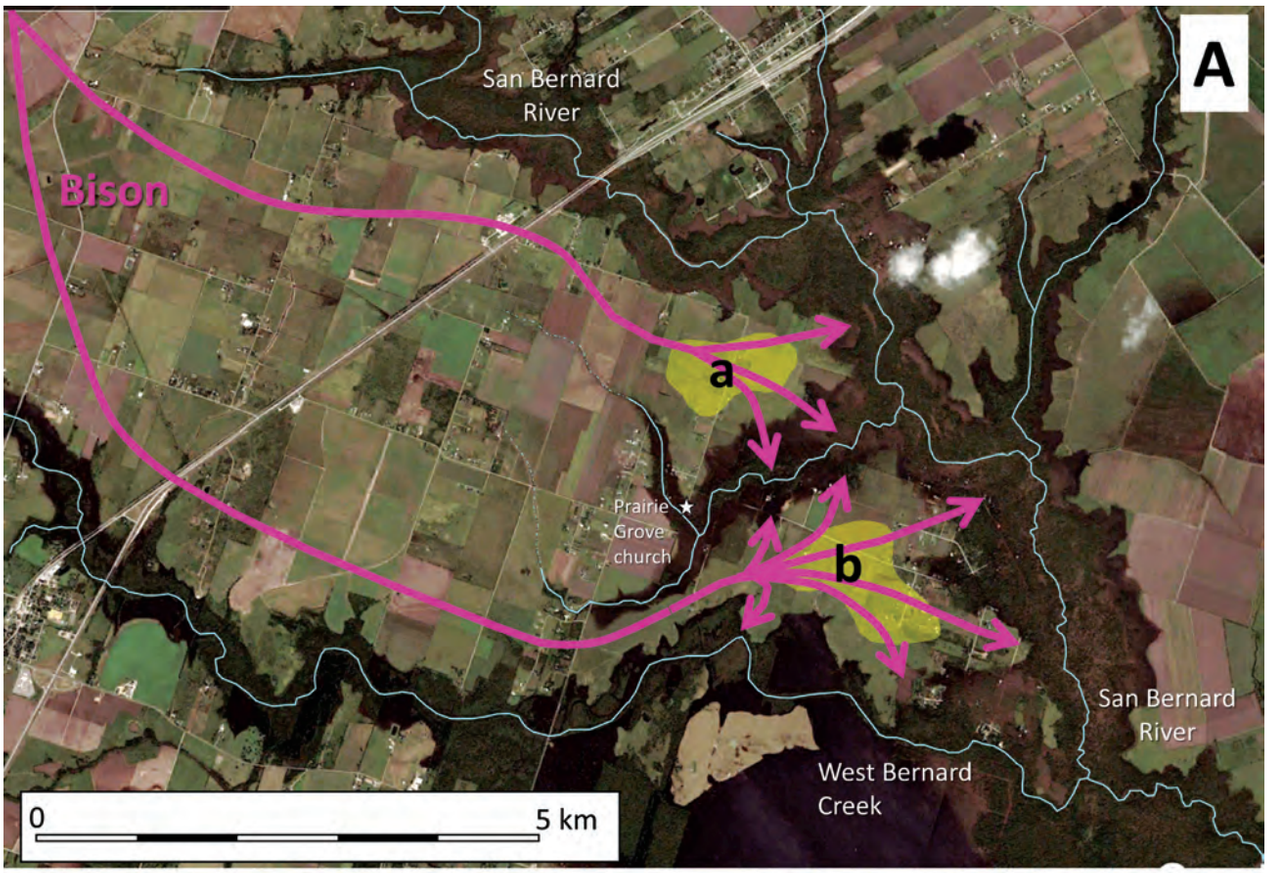

Figure 8.42. Knives of the San Bernard and Katy prairies. A-C: Large bifacial knives from 41WH65, San Bernard Prairie. The large numbers of accompanying large chert flakes and fractured cobbles at the site indicate that bifacial knives were being produced there. From Patterson and Hudgins, 1982. D, E: "Butted" bifacial knives from 41WH12, San Bernard Prairie. The upper edges are left blunt. From Patterson and Hudgins, 1989a. F: Corner tang knife from the Bowser site (41FB3), southern rim of the Katy Prairie; Patterson et al, 1998.

The geography of the vicinity of the Prairie Grove sites is displayed in a satellite photograph of that area (Figure 8.44a; location of photograph shown on Figure 8.39). The satellite photo was taken in late August 2017, when the area streams were full to overflowing as a result of Hurricane Harvey. The areas of darkened cropland show low country around the streams that was very likely forested in the historic past; farmers tend to chip away at the forested edges of their fields over time. The pattern that emerges is of two small forested enclosures (yellow shading): one partial enclosure (labelled A), and one nearly completely enclosed (B). Both have restricted openings, especially B. As accompanying Figure 8.44b shows, sites with bison remains ring or partly ring the two enclosures. The sites are located in the forested streams that surround the prairie enclosures. This suggests that bison were driven, possibly with fire, down the funnel formed by the intersecting San Bernard River and West Bernard Creek (Figure 8.44b), there to be somehow harvested.

Figure 8.43. A pair of bifacial knives (chip-sharpened on both faces) from the San Bernard prai-rie, from Patterson (2005b). Upper figure is from 41WH19 on West Bernard Creek; lower figure is from 41FB225 (near Big Creek).




Two potential harvesting methods are suggested from ethnohistorical accounts of the region. The first involves impoundment traps, similar to that described by Stanford (1978) at the Jones-Miller site in northeastern Colorado, where a brush-lined impoundment trap was apparently used in a low-relief prairie setting by communal Paleoindian hunters to entrap bison. Notionally, Native Americans would follow or force herds of bison (and deer) down the prairie in between the



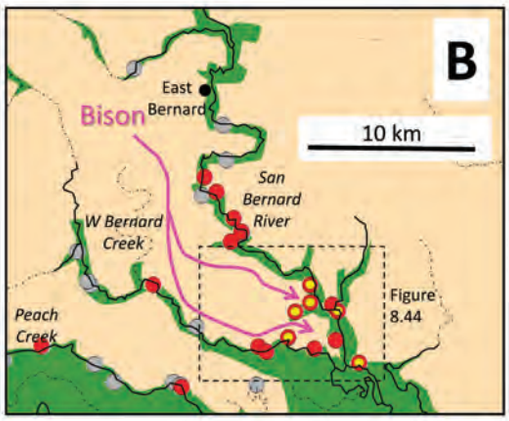




Figure 8.44a A. Aerial photograph of the Prairie Grove area in the San Ber-nard Prairie, showing inferred bison drive lines (pink arrows) and potential impoundment areas (yellow). Photograph taken during Harvey flooding in 2017, when water filled in the low areas surrounding the creeks, giving a good approximation of the pre-farm-ing extent of riparian forest. Note location of Prairie Grove church. Airphoto courtesy of Google Earth.
B. Regional perspective; dashed outline shows area of aerial photograph. Points shown are of clayballs, as per Figure 8.42.

Bernard River and West Bernard Creek (e.g., as shown in Figure ıb) until, at the end of the cul-de-sac the harried animals en-d one of the impoundments via the restricted openings. Hunters ld notionally then emerge from the surrounding forest and move lose the openings; killing would ensue on the small prairie areas ıe frightened animals milled around in the enclosures. However, large geographic size of these ringed prairies argues against such oundment; the prairie at B measures 2 x 3 km, which would seem ry large area for such a maneuver.

An alternate interpretation is that bison entering either of the cul-de-sacs would be panicked by fire or by human "beaters" ›oth, and then run off the edge of the high prairie and into the much lower stream beds, there to be slaughtered by waiting hunt-ers. The notional, inferred pink drive lines on the satellite image of Figure 8.44a show that bison might be run off the high prairie enclosures into the topographically lower surrounding streams in any of several directions; Figure 8.44b shows the encircling ring of archeological sites. Once the animals were in an enclosed area, it may be that it was difficult or impossible for the hunters to direct exactly which way the bison would run, hence the resulting ring of sites, built up over millennia.

Figure 8.45 shows the situation on the ground near site 41WH19. The flat prai-rie of Enclosure B, at the left, is about 8 to 10 meters higher than adjacent West Bernard Creek to the right. Bison running from the left (northwest) would likely stumble over the steep slope into the creek. Hunters waiting on the south (right)

bank of the creek could then send atlatl darts (or later, arrows) into the floundering, possibly injured animals (the woodcut shown on page 81 is an artist's scaled interpretation of that hypothesis). The animals killed would be processed in campsites in the surrounding forested stream valleys, where water and firewood were available. Evidence of such use includes bison (and deer) bones, lithic butchering tools (knives and scrapers), and cooking paraphernalia (clayballs, hearths, and ceramics). Of the two enclosures, area B seems to have been the one used more often and extensively.

Site 41WH19, in that second enclosure, contains in its 2.5 meters of stratified fill a few radiocarbon dates ranging from ca. 9920 rcyBP (ca. 11,500 BP calibrated) near its base to AD 1585 near its top—evidence of many millennia of site occupation (Patterson et al. 1987). Those dates came from charcoal, which was also found at numerous intermediate levels throughout the stratigraphic column; lack of funding prevented dating of all the charcoal samples. As the charcoal was not related to individual hearths by the researchers, it may be that the charcoal is evidence of multiple instances of ground fires, suggesting (but hardly proving) the repeated use of fire to drive the bison. Fire moving under the influence of a wind from the north-northwest, as would be likely in late fall and winter, would stop only at the stream, if then. Only a determined research effort at that site, especially in prairie areas away from the midden itself, could fully evaluate that scenario.

Hunting at this group of sites started as early as the time of Folsom technology in the Early Paleoindian Period. As mentioned, a proboscidean bone at site 41WH19 indicates that the site might have been used during Clovis time, because mammoths and mastodons did not survive into Folsom time. Projectile points of hunters from the Central Texas Balcones, Trinity-Sabine, and Central Coast-South Texas cultures suggest an alternating, periodic occupancy lasting at least through the Late Prehistoric Period and perhaps into the early Historic Period (Figure 8.33). The location's obvious geographic advantages would have made these cul-de-sacs a remembered and favored area for communal hunting.

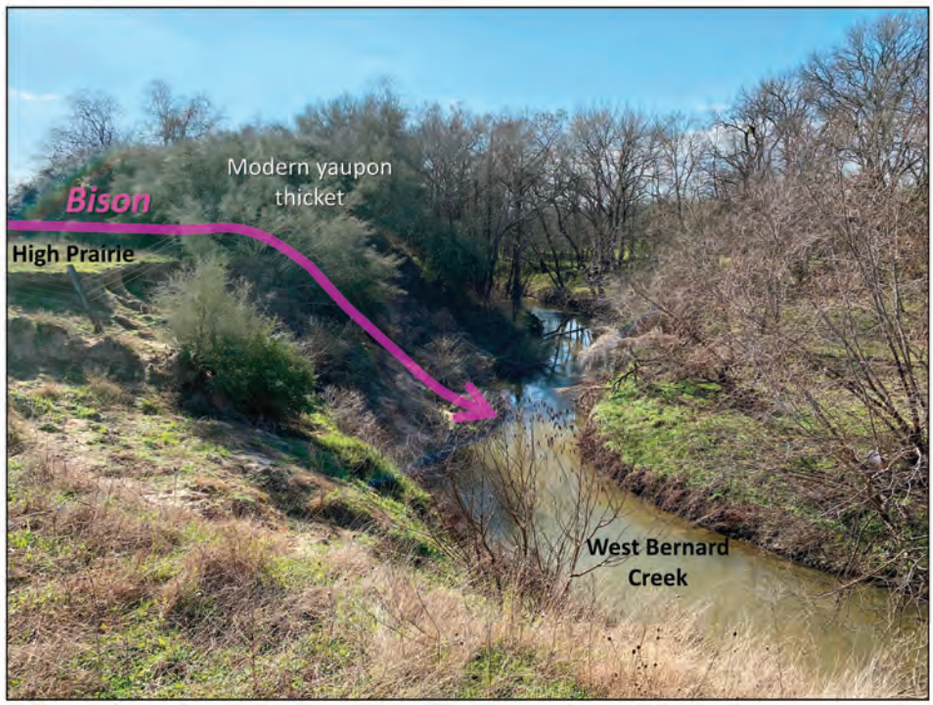



Figure 8.45. A potential bison leap at the edge of prairie enclosure b, San Bernard Prairie (see Figure 8.44a). The view is toward the southeast; the southern edge of enclosure b is to the left. Excavated site 41WH19, with multiple levels of encountered bison remains, is nearby around the bend in the river. Presumably, hunters could wait on the southern side of West Bernard Creek while other colleagues ran the bison over the steep, 8- to 10-meter-high cliff.

## Bison or deer?

A deeper look at the faunal information at the sites at Prairie Grove suggests a problem with what otherwise might seem like a reasonably compelling interpretation of a recurrent communal mass kill site for bison. At Prairie Grove and indeed at most sites in the San Bernard Prairie, only small amounts of bison bone have been found, although abundant deer remains were found at nearly every site, and were found at nearly all excavated levels at well-stratified sites. Most of the summary interpretations at these archeological sites state that deer (and turtle) were the main animals consumed (e.g., sites 41FB34 and 41FB42 on the San Bernard River; McClure 1986b; Patterson et al.1993b). Moreover, some sites in the Prairie Grove area have very large numbers of clayballs located at multiple stratigraphic levels but no bison bone, such as 41WH73, 41FB42, and 41WH21. The obvious questions include: (1) If the sites at Prairie Grove, and indeed elsewhere in the San Bernard Prairie constitute a long-term bison hunting area involving several distinct and (in some cases) far-travelled Native American groups, why is there not more bison bone found at the sites? (2) Why is there always much more deer bone recovered than bison bone, even where bison bone is present, and does it mean that deer always is the volumetrically more important food, even in an ostensible bison-hunting zone? These questions are addressed below, but first it is necessary to explore available analyses of faunal remains at these San Bernard Prairie sites.

Figure 8.46. Bison bone from an archeological site in Liberty County. From the Kyle Collection, photo courtesy of Wilson W. Crook III.

### Faunal remains and diet

As was discussed in previous sections of this report, bone preservation is generally poor in the humid, acidic soils of the prairie area, and plant remains are even more rare. However, a fortuitous situation along a part of the San Bernard River has yielded much better preservation of bone (although not of plant material). Along the San Bernard River south of the town of East Bernard (see the encircled area marked "3" on Figure 8.32) are seven sites where soil middens contain significant amounts of freshwater mussels. Some of these freshwater shellfish were eaten by occupying Native Americans as a minor part of their diet, and the shells were also deposited naturally, by river floods. The result was that the calcium carbonate in the buried shells counteracted the acidity of the soils, yielding much better bone preservation and a greatly improved record of the local Native American diet (McClure 1993).

The animal remains at these sites were studied by William McClure in a series of detailed faunal reports. From upstream to downstream, they are: 41FB35 (McClure 1993); 41FB34 (McClure 1986b); 41FB37 (McClure 1987a); 41FB32 (McClure 1989); 41WH50 (McClure 1991b); and 41WH20 (McClure 1991c). Collectively they present the most complete known documentation on the faunal remains and diet of the inland residents in the prairie zones of Southeast Texas. Of these, site 41FB37 is perhaps typical and will serve as an example. This site contains evidence of occupation from Late Paleoindian to Early Ceramic time. Fired clayballs are found at all levels, some charcoal is present, and about 35% of animal bones are burned, demonstrating that evidence of cooking is present and that the species represented in the midden were presumably nearly all being eaten.

Freshwater mussels were a minor part of the diet (Neck 1986), and were consumed at site 41FB37 beginning in the Early Archaic (Patterson and Hudgins 1987a). Their shells form a shell midden at several sites in this group, such as 41FB35. Fish consumed include gar, freshwater drum, sunfish, and catfish. Amphibians include toads and bullfrogs. Reptiles include mud turtles, stinkpot (a small turtle), alligator, sliders, box turtles, softshell turtles, and Texas horned lizards. Reptiles also include the following snakes: eastern hognose, kingsnake, coachwhip, water snake, coral snake, cottonmouth water moccasin, western diamondback rattlesnake, and other unidentified species of snakes. Birds include turkey and various unidentified genera. Mammals include opossum, mole, cottontail rabbit, black-tailed jack rabbit, pocket gopher, mouse, hispid cotton rat, and the two larger mammals: deer and bison.

Of these animals, fish, turtles, snakes and deer remains were most common. Moles and gophers may have been later burrowers and were not a significant part of the diet. It is likely that small reptiles and mammals were added to the diet in in times of need but were not the main target. As a proportion of the diet (in biomass), deer was very significant, and obviously a big part of the reason prairie hunters and their large projectile points were here. In all these sites, deer bones were the most prevalent large mammal remains found by far, which mirrors the findings in the Katy Prairie discussed earlier.

Bison bone was only found at one of these sites (41FB37). A part of a bison rib bone at that site was the only evidence among all seven sites for the presence of this animal, despite the fact that deer bones were present throughout and that several of these sites contained significant numbers of clayballs at multiple levels. As discussed, archeological data show that the fired clayballs were substituted for hot rocks in cooking, as both have been found together in in-ground pit hearths along the Colorado River to the west; ethnohistorical data link rocks to the in-ground boiling of meat and offal in pits draped with raw bison hides. Moreover, as noted, clayballs are focused in the Katy and San Bernard prairies where most bison remains are found, and deer remains are found throughout the Southeast Texas region, even where clayballs are generally absent.

The largest concentrations of fired clayballs fall in a cluster slightly farther to the south in the Prairie Grove cluster of sites. Five sites in the Prairie Grove cluster each contain more than 1,000 fired clayballs. The sites in this cul-de-sac area also contain the highest incidence of bison bones (five sites), but only as very scant single bone or tooth fragments, except in the case of 41WH19, where small amounts of bison bone are found at all levels from Early Archaic through Late Prehistoric (Patterson et al. 1987). At the Ferguson site (41WH42) in the cul-de-sac area, fully 15,188 fired clayballs were found—the most anywhere in the state of Texas up until that time—distributed at all levels from Late Paleoindian through the Late Prehistoric Period (Patterson et al. 1993b). But there were no bison bones found, and deer and turtle remains were abundant.

At White Oak Bayou in the Katy Prairie, already discussed, several nearly complete bison skeletons of Late Prehistoric age were found; they were found as nearly complete skeletons in gullies where they had been killed and butchered. However, bison remains were generally scant or absent at campsites in the White Oak Bayou area, and deer bones were abundant. At the Alabonson Road site (41HR273) along

White Oak Bayou in the Katy Prairie, close to these bison kill sites, an Early Ceramic occupation was interpreted as a base camp where the primary large mammal consumed was deer, as evidenced by 338 identified bone fragments at all layers of the site. Deer leg bones were disproportionally represented versus spines and skulls, leading researchers to conclude that deer there had been butchered and quartered offsite (Ensor and Carlson 1991).

Deer bone is nearly ubiquitous in all sites in both prairies where any bone at all is preserved, leading the archeologists of the 1980s and 1990s at these sites to conclude, in site after site, that venison was the most voluminous food by far, followed by turtles, fish, and various small reptiles, amphibians and mammals (e.g., McClure 1986a, 1991a), and that the relative importance of bison must be small. Deer bones usually occur at all levels where bone is encountered, and they often show cut marks; at 41FB32 in the San Bernard Prairie a wide variety of types of deer bones suggests that at that location they were butchered whole on site (McClure1987b, 1989).

This underscores the questions already asked more generally: Why is there not more bison bone, even when sites like these show evidence of relatively good bone preservation, and when there is evidence from lithic and ethnohistoric data that bison were likely to have been present? And should we reconsider the theorized link of clayballs with bison?

### Butchering mechanics vs. bone presence at sites

The simplest answer to the question "Where are all the bison bones?" is that in general, bison meat was brought into camp, but not bones. For this explanation, we can refer either to the work of Joe Ben Wheat (1967) at the Late Paleoindian Olsen-Chubbuck bison kill site in eastern Colorado, or we can follow ethnohistoric descriptions of Plains Indians of the Historic Period; the accounts are similar. Wheat studied the remains at the Late Paleoindian Olsen-Chubbuck site of over 200 bison that had been led into a five-foot-deep dry arroyo trap, were slaughtered, and then were butchered on site by the hunters; the projectile point of choice was the Scottsbluff. What Wheat found was a very well-ordered meat processing site:

> *As we excavated the bone deposit we first uncovered the upper layer containing the single bones and articulated segments of skeleton. It was soon apparent that these bones were the end result of a standardized Paleo-Indian butchering procedure. We came to recognize certain "butchering units" such as forelegs, pelvic girdles, hind legs, spinal columns and skulls. Units of the same kind were usually found together in groups numbering from two or three to as many as 27. Similar units also formed distinct vertical sequences. As the hunters had removed the meat from the various units they had discarded the bones in separate piles, each of which contained the remains of a number of individual animals. In all we excavated nine such piles.*

Acting like a forensic pathologist, Wheat methodically assembled the evidence and produced a play-by-play of the inferred butchering process:

> *The hunters' first task had evidently been to get the bison carcasses into a position where they could be cut up. This meant that the animals had to be lifted, pulled,*

*rolled or otherwise moved . . . to some flat area. . . . The way in which the butchering units were grouped suggests that several bison were moved into position and cut up simultaneously. Since foreleg units, sometimes in pairs, were found at the bottom of each pile of bones it seems reasonable to assume that the Paleo-Indians followed the same initial steps in butchering that the Plains Indians did in recent times.*

*The first step was to arrange the legs of the animal so that it could be rolled onto its belly. The skin was then cut down the back and pulled down on both sides of the carcass to form a kind of mat on which the meat could be placed. Directly under the skin of the back was a layer of tender meat, the "blanket of flesh"; when this was stripped away, the bison's forelegs and shoulder blades could be cut free, exposing the highly prized "hump" meat, the rib cage and the body cavity. Having stripped the front legs of meat, the hunters threw the still-articulated bones into the arroyo. If they followed the practice of later Indians, they would next have indulged themselves by cutting into the body cavity, removing some of the internal organs and eating them raw. This, of course, would have left no evidence among the bones. What is certain is that the hunters did remove and eat the tongues of a few bison at this stage of the butchering, presumably in the same way the Plains Indians did: by slitting the throat, pulling the tongue out through the slit and cutting it off. Our evidence for their having eaten the tongues as they went along is that the tongue bones are found throughout the deposit instead of in one layer or another.*

*The bison's rib cages were attacked as soon as they were exposed by the removal of the overlying meat. Many of the ribs were broken off near the spine. The Plains Indians used as a hammer for this purpose a bison leg bone with the hoof still attached; perhaps the Paleo-Indians did the same. In any case, the next step was to sever the spine at a point behind the rib cage and remove the hindquarters. The meat was cut away from the pelvis (and in some instances simultaneously from the hind legs) and the pelvic girdle was discarded. If the hind legs had been separated from the pelvis, it was now their turn to be stripped of meat and discarded. After the bison's hindquarters had been butchered, the neck and skull were cut off as a unit—usually at a point just in front of the rib cage—and set aside. Then the spine was discarded, presumably after it had been completely stripped of meat and sinew. Next the hunters turned to the neck and skull and cut the neck meat away. This is evident from the skulls that had vertebrae draped over the front; this would not have been possible if the neck meat had been in place. The Plains Indians found bison neck meat too tough to eat in its original state. They dried it and made the dried strips into pemmican by pounding them to a powder. The fact that the Paleo-Indians cut off the neck meat strongly suggests that they too preserved some of their kill. If the tongue had not already been removed, the jawbone was now cut away, broken at the front and the tongue cut out. The horns were broken from a few skulls, but there is little evidence that the Paleo-Indians broke open the skull as the Plains Indians did to take out the brain.* (Wheat. 1967)

Once the spine and skull were placed into nearby discard piles, all that re-

mained was a pile of raw meat on a skin "mat," with perhaps some blood saved in a bag made from an intestine. This material was then ready to remove to camp for next stage food processing—without any bones.

The Arikara Indians of Indiana during the Historic Period used nearly the identical method as was deduced by Wheat from archeological remains of a people living 11,000 years earlier (Gilmore 1923):

> *To save unnecessary weight in transportation the cutting was planned to strip all the meat, leaving the bones on the prairie where the animal was killed, except the backbone, the neck and the ribs which could-not well be stripped out. These pieces were used for immediate cooking and eating [and those bones too left on the prairie], while the rest of the muscular structure was taken into camp and there cut into thin strips and dried for preservation.*

Hence the amount of bison bones brought into camp was small to perhaps nil, using a butchering method that had passed the test of a very long span of time. An image from 1875, drawn by an imprisoned Cheyenne warrior, depicts the same process of skinning the bison, belly-side down, at the kill site (Figure 8.47). The reason for butchering these animals at the kill site rather than at camp is clear. A full-grown buffalo weighs from 1,000 to 2,200 pounds (and weighed even more in Paleoindian time), and is simply too heavy to move, other than by two or three hunters laboriously turning the carcass over for butchering. In comparison, a white-tailed deer averages about one tenth that weight, and could be readily carried to camp intact or nearly so by Native Americans, who by all accounts were well muscled for the task. At 41FB32 in the San Bernard Prairie, evidence shows that deer were butchered whole in camp, whereas at the Alabonson Road site (41HR273) they were brought into camp mainly as leg quarters; either way, deer bones were brought into camp along with all deer kills.

Reflecting upon the ring of sites around enclosure B at Prairie Grove (Figures 8.41 and 8.44), the kill site would notionally have been along the margins of the enclosed prairie, where the animals would have been driven over bluffs into the adjacent creeks (Figure 8.45). The animals would have been butchered there, just as the bison at the arroyo trap at the Olsen-Chubbuck bison kill site or at the Jones-Miller impoundment trap were butchered in place. The meat and hides would then have been taken to one or more campsites along the forested streams, some tens of meters away, for processing. If this was a process akin to that of Plains people, some meat and perhaps blood would be boiled or roasted; other meat would be sliced thin to dry into jerky, perhaps with an adjunct of smoking to hurry up the process in a humid environment; pemmican would be made by mixing jerky with nuts or berries and rendered grease, and stored in leather bags; and hides would be scraped and cured for use as tent covers, blankets, and

Figure 8.47. The butchering of a buffalo on the plains. From a book of drawings by a Cheyenne warrior named Bear's Heart, about 1875; he was imprisoned at Fort Marion. The buffalo carcass was skinned belly-side down, just as had been done by both the Paleoindians studied by Wheat and the Histor-ical Period Arikara observed by Gilmore (see text). Image NAA MS 4605 (INV 08511101), courtesy of the National Anthropological Archives, Smithsonian Institution.

winter clothing. This was the classic autumn and winter work of Plains women, and would account for the Bidai and Akokisa winter camps in the Katy and Grimes prairies seen by the Spanish in February.

In the case of Simars de Bellisle and his Akokisa companions in 1720 following their successful bison hunt in the Katy Prairie, the butchered meat was packed for a multi-day trip back to the coast:

> *They decided the next morning to return to the place [on the coast] where they had left their wives. We left accordingly at daybreak. All I could do was follow them, running as fast as I could. In addition, they had given me my portion of the meat to carry. The second evening we reached a little river, where we passed the night . . . and I slept without waking up. Then I had to leave to join the wives, where we arrived at four o'clock in the evening.* (Folmer 1940)

Presumably the meat was smoked before being taking for a three-day journey, but the narrative does not mention how the "meat" was prepared. One thing seems certain, however: not much if any heavy bison bone made it back to the coastal camps.

As we have seen, a straightforward hunter-gatherer lifestyle was practiced in these prairies from the Early Paleoindian Period through the Late Prehistoric with little obvious change. The upshot of the discussion of bison and deer remains and fired clayballs is that the absence of bison bone at a site is not *necessarily* indicative of the absence of bison consumption. Corollaries of that conclusion are that scant bison remains in the presence of abundant deer remains are not necessarily evidence that deer was by volume the most important animal food source at that site, and that the relative absence of bison bones in the presence of large numbers of fired clayballs does not necessarily mean that fired clayballs must be related to cooking of other species, or of plant materials.

## Time periods of bison presence and absence

The caveat "necessarily" is needed in the preceding paragraph, because more than one cause can affect negative evidence of bison at a site. For example, consider the periodic absence of bison even in an area so apparently linked with bison hunting as the Katy and San Bernard prairies. Dillehay (1974) proposed a succession of five time periods when bison appear to have been present or absent on the Southern Great Plains extending into Texas, based upon study of 160 archeological and paleontological sites. Dillehay began his study when he noted—as was mentioned earlier—that bison remains were curiously absent at many excavated sites. He quoted Dibble (1968), who discuss the rarity of bison bones at the Bonfire Shelter site in the Lower Pecos Region, Valverde County:

> *The general lack or rarity of bison bones from sites in the area must be taken as good, albeit negative, evidence that the region was not, for any great length of time, within the usual range of the modern species. It would only seem logical that if bison had ranged here in significant numbers the inhabitants would have exploited them as a food resource and their remains would be strongly represented in midden debris.* (Dibble, 1968)

Setting aside our preceding discussion—which tentatively ascribed bison rarity at certain Southeast Texas sites, at least in part, to longstanding Native American butchering practices—consider for a moment as Dillehay did that regional bison absence might be a periodic occurrence. Dillehay compiled information from 160 sites in the southern Great Plains, mostly from Texas but including others from eastern New Mexico and Oklahoma. He sorted them by archeological period, using radiometric dates and lithic artifact chronology. He concluded that data from these sites supported the presence of bison during three archeological time periods (plus the early Historic period) from Upper Paleolithic through Late Prehistoric time (the green zones in the column shown in Figure 8.48), with two prominent intervening periods of absence (red zones). He related these fluctuations in bison population to shifts in range, primarily related to climate. The core homeland of the bison is the Great Plains (the southern Great Plains of Oklahoma, Kansas, Nebraska, and the northern Great Plains of states farther north). Dillehay reasoned that Central Texas, the Lower Pecos region, and South Texas are fringes to this area, and that in times of inclement climate—extended droughts and heat—bison herds would presumably stay in their core region to the north of Texas, and not venture into the hotter, drier fringes of their range. Times of cooler, more humid weather would coax the bison farther south, yielding an archeological column at well-stratified, long-occupation sites of periodic presence and periodic absence.

Numbers of sites in Southeast Texas with either bison or deer remains are plotted in the central three columns of Figure 8.48, showing that bison remains have

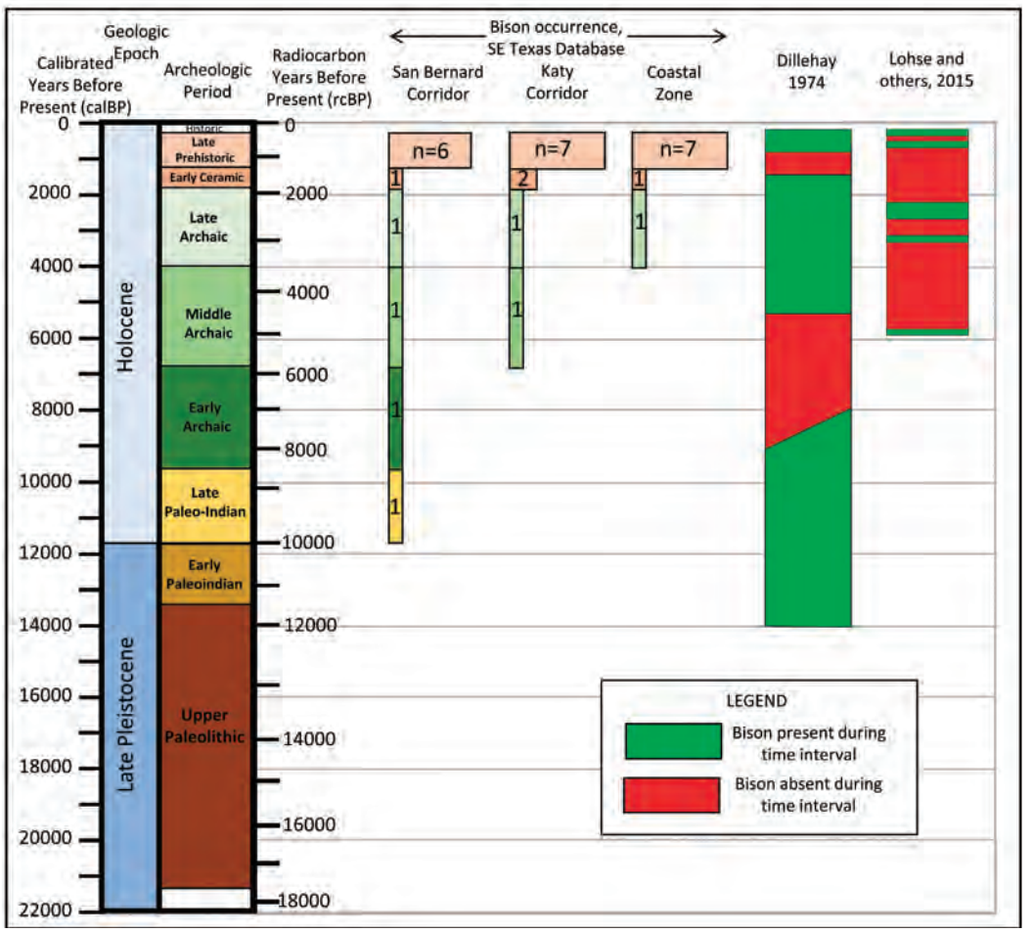



Figure 8.48. Data relating to the pres-ence or absence of bison in Southeast Texas and the southern Great Plains during prehistory. To the right of the time chart, three columns show plots of occurrences of bison remains in Southeast Texas archeological sites, as compiled in Appendix 2. The right two columns depict the periods of bi-son abundance in the southern Great Plains from the studies of Dillehay (1974) and Lohse and others (2013).

been found only in the Katy and San Bernard prairies and the coastal zone. As Dillehay observed, there is a general lack of bison remains in archeological sites of the eastern Texas forest, as can be seen, albeit incompletely, in Figure 8.1. This is the result either of no bison entering the forest (they are primarily plains animals) or of the high acidity of the soils denying preservation (although deer bones are typically preserved). Unfortunately, many sites in that region of Southeast Texas are merely surface collections, and excavations of well-stratified sites are rare.

The Southeast Texas sites containing bison remains were compiled by Patterson (1996) and updated for this report; they are listed in Appendix 2 by age. These dates are all assigned time ranges by lithic chronology, as was the practice of Dillehay in his compilation. There are no known radiometric dates of bison bones yet compiled for the Southeast Texas region. Those that could be assigned to particular periods are shown in Figure 8.48, divided into columns representing the three regions where they were found. These three columns each show a great preponderance of bones in the Late Prehistoric; in fact, there are six or seven times as many remains in that period as in any other older period. While it is possible that bison were seven times as common then, or perhaps hunted by seven times as many people, it is more likely that this shows in great part the rapid physical degradation and disappearance of bones through time, as evidenced in soil middens. Such was noted in general counts of bones of all types at 41WH19 (Patterson et al. 1987). Even young, Late Prehistoric occurrences of bison material can be severely degraded. At Alabonson Road (41HR273) on White Oak Bayou, near several bison kill sites, bison remains exist only of twelve enamel tooth fragments; no other bone was found (Ensor and Carlson 1991).

Very few bison bones in Southeast Texas represent time periods older than Late Prehistoric, and the low frequency in general of older bison remains, as well as local absence in stratified deposits, may have as much to do with rapid bone degradation as with absence by offsite butchering. Any bones that did make it to camp would likely have been for the purpose of marrow and grease extraction. A high percentage of deer bones at Alabonson Road contained severe spiral fractures, leading Ensor and Carlson to deduce that marrow extraction had occurred. Brink (2008) noted that Native People at the Head-Smashed-In site in Alberta thoroughly smashed into small fragments any bones used for marrow extraction, and then boiled them in hide-lined pits, using hot stones for heat (Brink 2008). These pit hearths at the site are relatively young and have been radiocarbon dated from a few hundred to 1,800 years BP (Brink and Dawe 1989). Smashed bone fragments subjected to boiling would presumably not be good candidates for preservation in the humid, acid soils of Southeast Texas.

Dillehay's interpreted periods of presence and absence are shown to the right of these three columns (Figure 8.48). A first analysis would suggest these data are incongruent with Dillehay's 1974 findings, as remains are found in the three areas that overlap his periods of absence. Looking more closely, however, one can see that the periods used in the Southeast Texas lithic chronology of this report overlap Dillehay's periods of absence; for example, the Middle Archaic is partly in the presence interval, and partly in an absence interval, rendering moot the issue of correlating with Dillehay's findings by lithic chronology. This issue points out

the difficulty of using lithic chronology in assigning time periods of any sort: it is a blunt and inexact tool, appropriate only for assigning artifacts to relatively large periods of time, with broad error bars.

Recognizing this issue, Lohse and others (2015) refined the methodology by restricting their database to the southern end of the Great Plains in central and southern regions of Texas, and most importantly by using only higher-precision radiocarbon dates of bison bone that do not cross-reference to dates from adjacent lithic artifacts. This allowed a sharper focus on periods of presence or absence of bison (Figure 8.48, right column). Their data, chosen to focus on the southernmost part of the Great Plains during the last 6,000 years, consisted of 44 radiocarbon dates from 14 sites. They were able to define four main time periods plus the early Historic when bison were present, or at least were being exploited by Native Americans. They related these to cultural periods when Native Americans exploited greater numbers of bison, presumably due to environmental and climatic factors. One of these periods, correlating to the time of use of the Bell and Andice projectile point style, can be related to a specific time of moist climatic conditions in Texas precipitation data of Wong and others (2015), as was discussed in Chapter 7 and shown on Figure 7.3.

The Lohse and others (2015) database did not extend into Southeast Texas, nor do those authors suggest that their chronology extends necessarily into such adjacent areas. Nonetheless, it is suggestive of the precision that might be possible given such well-dated bone samples. Unfortunately, available data showing the occurrence of bison remains in Southeast Texas, from 39 sites (Appendix 2), include only dates from lithic chronology. For example, a Perdiz arrow point at site 41HR541 indicates a Late Prehistoric time period (1400–500 BP), but does not have the precision of a radiocarbon date of a bone into which the point is imbedded, which could be precise to within a hundred years or less. For this reason, the Southeast Texas data as plotted on Figure 8.48 has a coarse and blocky appearance, with no discernable gaps. It is not generally possible with current data to be more precise.

However, in a few sites where we have detailed stratigraphy and radiocarbon dates, it is possible to spot test Lohse's results. At sites 41HR541 and 41HR406 on White Oak Bayou, bison kill sites are dated by adjacent lithic points to the Late Prehistoric Period. At the nearby Alabonson Road site (41HR273), detailed excavations reveal an Early Ceramic occupation of dated duration 1600–1200 BP succeeded by a Late Prehistoric settlement (Ensor and Carlson 1991). The Early Ceramic occupation was as a base camp, where full use was made of bayou and prairie resources, including flora and fauna. The primary large mammal was deer, as evidenced by 338 identified bone fragments at all layers of the site. In contrast, only a handful of "bovid" (probably bison) remains were found, as enamel fragments of teeth in the uppermost levels of the site (probably Late Prehistoric). These data are consistent with the chart of Lohse and others (Figure 8.48, column on right), which depicts a dearth of bison remains in their South Texas study area during the Early Ceramic period, and significant numbers of bison during the Late Prehistoric. However, there are bison remains attributed to the Early Ceramic Period at three other locations in the Southeast Texas region, as shown in the chart and in the table, despite the posited absence of bison in Lohse's study. It is left to future workers to unravel

this potential issue, the resolution of which would presumably require radiocarbon dating of specimens. For the present, we can assume that the absence of bison bones at a prairie or coastal site, or at a particular level in a prairie or coastal site, may mean any of three things:

1) There were no bones brought to camp, as bison were butchered where killed.

2) Those few bison bones that made it to camp were not preserved due to soil acidity in sites older than Late Prehistoric.

3) Bison were not at this site at particular times during prehistory, due to the effect of vagaries of climate on the long-term migration of bison in the Great Plains.

## Summary

The Katy and San Bernard prairies constitute a lifeway zone of primarily seasonal and intermittent hunting of bison and deer that is quite distinct from the riverine and the coastal lifeways discussed in the previous chapter. Sites in these prairies share the antiquity of some Trinity River sites, with occupation starting at least by the time of use of Clovis tools in the Early Paleoindian Period, in the Late Pleistocene. A great many of the prairie sites indicate intermittent occupation of very long duration from the Early Paleoindian through the Late Prehistoric periods, with some locations even extending into the early Historic Period.

Ethnohistorical and archeological data show that communal hunting was practiced for both bison and deer hunting in this prairie region. A review of the geography and landscape of the sites shows that there are good reasons why the sites were revisited so many times over the millennia. A cluster of sites on White Oak Bayou in the Katy Prairie indicates that a low bison jump was operated there, with bison being killed in the gully-like topography. A similar type of kill site is inferred for the dense cluster of sites at western Buffalo Bayou, where it is interpreted that bison were driven from the west along a long, narrow funnel in between two forested streams before arriving at the kill site in what was likely an incised stream bed with low walls. In the San Bernard Prairie a similar long corridor between two forested streams led to two small prairie areas surrounded by forested streams, with narrow openings leading into small prairie enclosures. Bison may have been killed by running them over the margins of those enclosed prairies, over steep bluffs into surrounding streams.

In each of these three main settings in the Katy and San Bernard prairies, the campsites were set up along forested streams presumably near the interpreted kill sites, taking advantage of the water and firewood needed for processing, preserving, and storing the harvest. Fired clayballs are associated with the cooking of bison meat by cultural groups of the Plains tradition, dating from Early Paleoindian time. It is here interpreted that clayballs substituted for heated rocks in inland settings, where a small earth pit was dug, lined with a fresh bison hide, filled with liquid, and then with heated stones or clayballs to induce boiling.

Geographic distributions of lithic, ceramic, shell, and bone artifacts show that

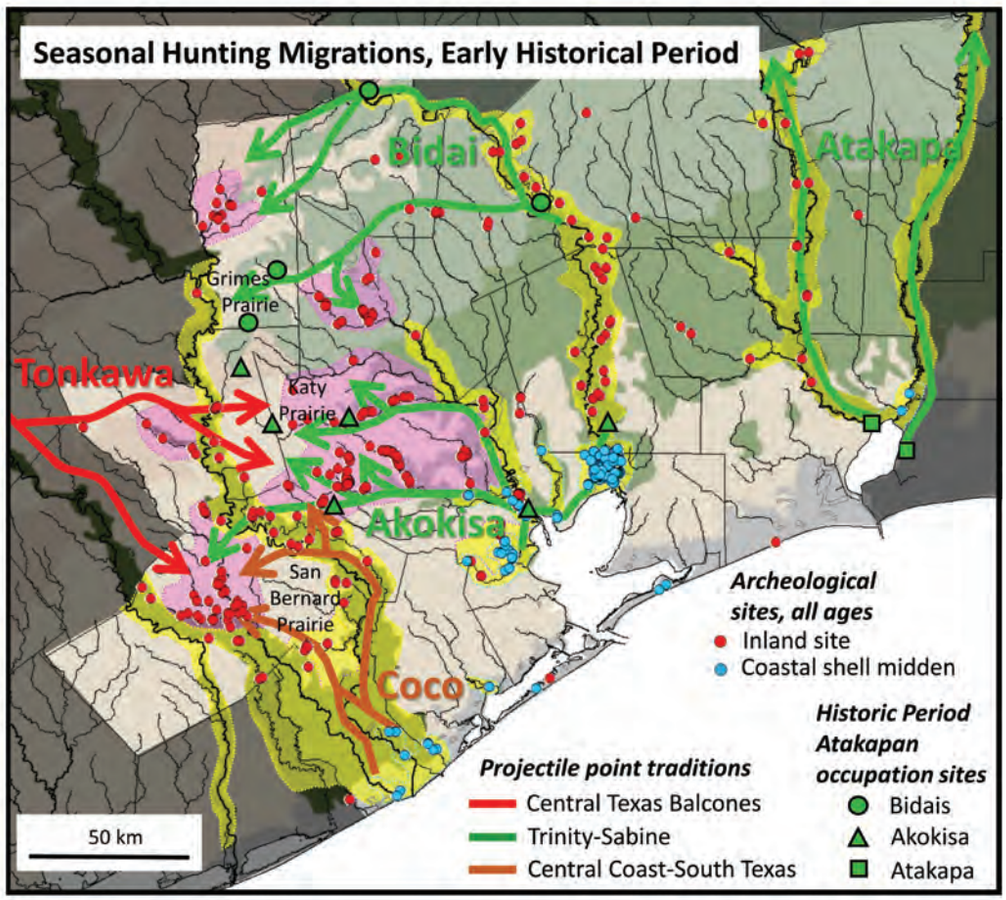



Figure 8.49. Interpretive model of seasonal migration of early Historic Period groups for the purposes of hunting in the Katy, San Bernard and Grimes prai-ries. See text for explanation.

the area was a cultural crossroads, utilized over the millennia by three regional traditions. The interpreted seasonal migration routes to this crossroads during the early Historical Period, taken from ethnohistorical sources mentioned earlier, are depicted in Figure 8.49 and are as follows:

1) groups migrating southeast along the Colorado River from the area of the Central Texas Balcones Tradition, following bison that seasonally migrated southward from north-central Texas into the Katy and San Bernard prairies (red arrows);

2) groups from the Trinity-Sabine Tradition (in the early Historic Period, Akokisa, Bidai, and Atakapa proper bands of the Atakapa), who primarily lived in the upper coastal zone and near the Trinity-San Jacinto and Sabine-Neches rivers. The Atakapa and Bidai came to the Katy and Grimes prairies to hunt in the fall and winter, and the Atakapa proper hunted in northern Louisiana and Missouri (arrows in shades of green); and

3) groups from the Central Coast-South Texas Tradition (in the early Historic Period, the Coco band of the Karankawa), who primarily lived in the coastal zone between the Colorado and Brazos rivers but who hunted in the inland San Bernard Prairie (and occasionally farther east in the Katy Prairie) in the fall and winter.

Ethnohistorical data suggest that the Trinity-Sabine Akokisa and Bidai as well

as the Central Coast-South Texas Karankawa spent most of their time during the year along the coast, but headed into the adjacent prairies in the fall and early winter primarily for bison and deer hunting. Late Archaic mortuary data from the Lower Brazos Culture show that the cross-cultural seasonal co-occupancy of the prairie hunting zone by the three traditions was not always amicable, with violent deaths the result.

Finally, a review of butchering customs in studies of both prehistoric kill sites and Historic Period ethnohistoric accounts suggests that butchering of heavy bison occurred directly at the kill sites on the prairie or along stream beds; bones were left there, and only meat and hides were taken to camp. Deer, however, were brought into camp either whole or in quarters. Because of this, deer bones are commonly seen at campsites to the exclusion of bison bones, even when data from surrounding sites and the use of fired clayballs suggest that bison hunting was a significant activity in the area. For this reason, it is not accurate to use the prevalence of deer bone over bison bone at archeological sites as necessarily indicating a volumetric prevalence of deer in the Native American diet in prairie regions.

# 9.

# Lithic tools and procurement zones

The procurement of lithic materials with which to make the tools to hunt, prepare hides, fashion clothing, build shelter, and make war is a primary concern of any hunter-gatherer people. At first glance, the flat and muddy Gulf Coast plain looks like a poor place to hunt for bits of rock, but Native Americans showed great resourcefulness in making the most of what the area had to offer. Lithic procurement zones, although not "lifeway" zones in the same sense as those discussed in the previous several chapters, nonetheless were critical to the lives of Native Americans in Southeast Texas. These procurement zones and the artifacts obtained from them are mapped and analyzed in this chapter, with maps displayed in Atlas III.

## Lithic procurement zones

In a detailed study of some 880 artifacts collected at McFaddin Beach in Jefferson County (41JF50), which range in relative age from Early Paleoindian Period (Clovis material culture) though the Late Prehistoric Period, Stright and others (1999) observed that exotic lithic materials – defined as materials procured from sites greater than 1,000km from the archeological site – were commonly used for projectile points only in Paleoindian times. Most lithic materials were procured locally, or at least regionally. The primary source areas for lithic materials in Southeast Texas are outlined on Frame 1 of Atlas III. These include:

1) A band of outcrops of the Eocene Jackson Group, the overlying Oligocene Catahoula Formation, and the base of the Miocene Fleming Formation that overlies the Catahoula contain abundant silicified wood, and locally contain silicified sandstone and ceramic-grade clay.

2) Outcrops of the Pliocene Willis Formation contain gravels and small cobbles of chert, quartzite, and silicified wood, as well as abundant sources of hematite that can be pulverized to produce red ochre.

3) The Colorado and Brazos rivers were sources of cobbles of Edwards and other types of chert as well as of quartzite cobbles emanating from the Rocky Mountains in New Mexico. Those rivers also carry lesser amounts of silicified wood from Tertiary outcrops that they transect. Most of the cobbles drop out of the rivers' carried bed loads and are deposited in point bar deposits well before reaching coastal counties. Edwards chert was also physically brought into the area, mostly as finished or nearly finished lithic items, probably by hunters of the Central Texas Balcones Tradition who hunted in the Katy and San Bernard prairies.

4) The San Jacinto, Trinity, Neches, and Sabine rivers and their tributaries carry gravel and cobbles in the form of silicified wood, quartzite, and flint eroded from nearby Tertiary strata. Most of the cobbles drop out of the rivers' carried bed loads and are deposited in point bar deposits before reaching coastal counties.

5) In coastal areas far removed from lithic source areas, shells, deer bone and gar scales were typically used as substitutes for lithic projectile points, knives and scrapers. Asphaltum for hafting projectile points as well as sealing baskets came from offshore and onshore seeps in the coastal zone.

Each of these source areas is described in more detail in the sections that follow.

### Jackson, Catahoula and Fleming resources

In the northwest corner of the Southeast Texas project area in Grimes County (location 1, Frame 1, Atlas III) are a number of sites that were shovel-tested in the 1970s to 1990s as part of a cultural assessment of the Gibbon Creek lignite mine area. Figure 9.1 shows a closeup topographic map of the site and highlights the presence (before strip-mining) of several historic era quarries, clay pits, and gravel pits that attest to a richness of geologic resources. The site locations bordering Gibbons Creek were taken as part of an area survey for an impending lignite strip mine that has since been built, and their locations thus reflect past needs of cultural resource testing. Most of the sites have since been destroyed by strip mining. Nonetheless, they show that Native Americans were active on the low ridges and slopes surrounding the creek from the Paleoindian through Late Prehistoric periods. The testing sites are apparently not typical hunting sites, as they are on ridges and in dry gullies rather than near water. Data are limited, but the sites show evidence of lithic reduction at hillside campsites in the form of lithic flakes, hammerstones, partly formed tools,

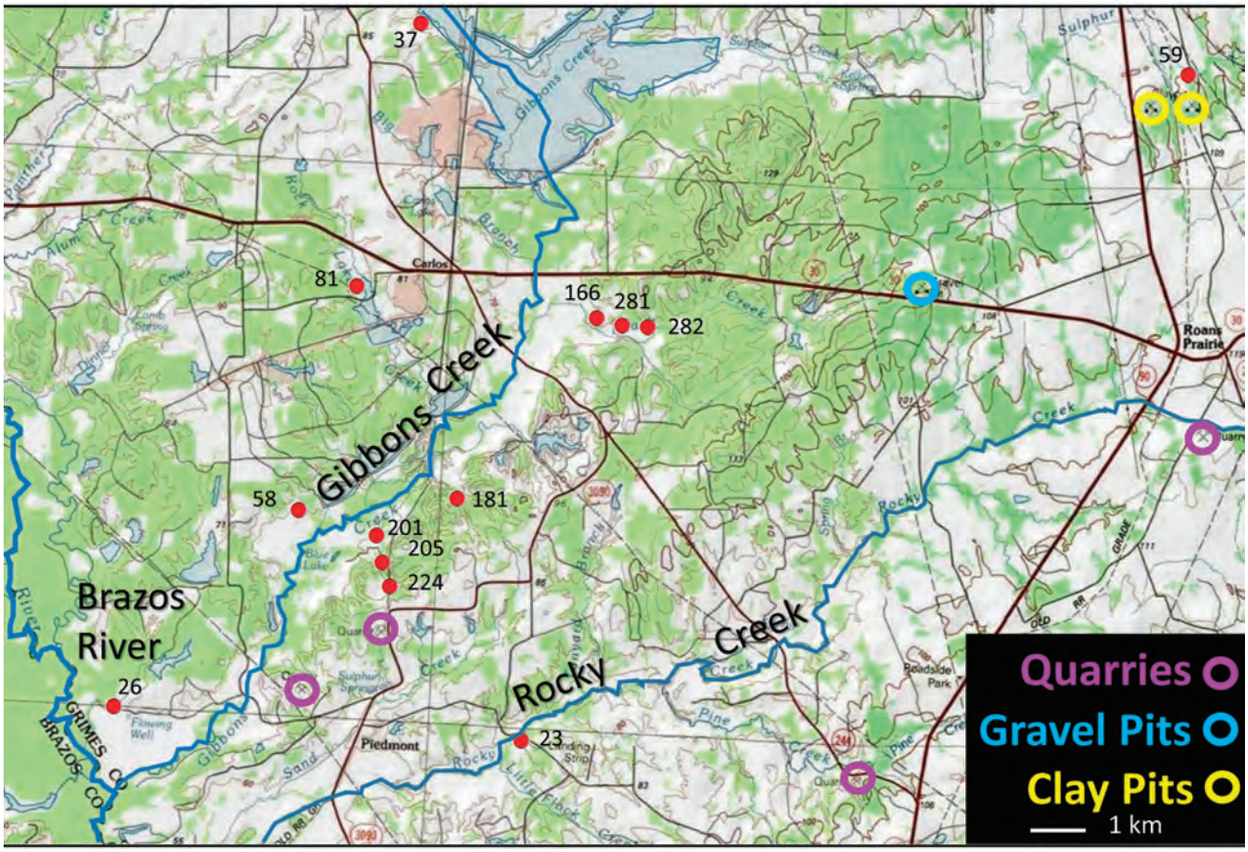
pottery sherds, and burned rock hearths (Bond 1977; Davis 1981; Rogers 1991, 1993, 1994b, 1994c, 1995; Clark 1988). At 41GM23, on Rocky Creek (location 23, Figure 9.1), a bifacial knife and another biface fragment were fashioned out of fossil palmwood (Clark 1988); the fossil wood is local to this area and suggests the area was being periodically searched for lithic resources. These sites lie within what is apparently a lithic procurement zone consisting of outcrops of the Eocene Jackson Group (including the Caddell, Wellborne, Manning, and Whitsett formations) and the overlying Oligocene Catahoula Formation to the east, as shown in the geologic map of Figure 9.2. These stratigraphic units and their resources are described from stratigraphic top to bottom in the rest of this section; geology and stratigraphic descriptions are taken from the *Geologic Map of Texas* (U.S. Geological Survey n.d.), unless otherwise noted.

The Oligocene to Lower Miocene Catahoula Formation is composed of mudstone and soft sandstone; fossil wood is abundant. The sandstone is typically soft, but there is extensive fracturing that facilitates local silica cementation, making a hard sandstone that is crushed for road metal (Mathewson et al. 1985). That hard sandstone would have been useful for Native American sandstone tools and metates (discussed later). The Catahoula is overlain in the southeast by the Miocene Fleming Formation, consisting of clayey sandstone and sandy clay. In its lower 3 m, near the upper contact with the Catahoula Formation, are paleo-stream channels that contain fossil wood fragments ranging in size from pebbles to intact logs, thought to have been redeposited from the underlying Catahoula (Singleton 2008). Both formations are important sources of fossil wood that was extensively used by people of the local Trinity-Sabine Tradition.

The Eocene Whitsett Formation of the Jackson Group consists of quartz sand, lignite, and common silicified fossil wood. The shales are tuffaceous (locally bentonitic) and contain opalized logs of silicified wood (Renick 1936). At site 41GM23 on Rocky Creek within the Whitsett outcrop area, as mentioned earlier, a bifacial knife and a partial biface were fashioned out of silicified (opalized) palm wood from this unit, and the gravel pit within the outcrop area likely contains fossil wood pieces. The topographic map (Figure 9.1) shows that there are modern clay pits near site 41GM59, suggesting that clay may also have been a search target for early visitors to the site.

The Eocene Manning Formation of the Jackson Group contains sandstone and mudstone, with numerous lignite beds and volcanic ash deposits (Yancey 1995) as well as common fossil wood. The Eocene Wellborne and Caddell formations of the Jackson Group comprise sandstone and clay, with no fossil wood noted.

Bentonitic clay from volcanic ash throughout the Jackson Group is a potential source of modern industrial ceramic-grade "ball clay," although present day production is greater in the underlying Wilcox and Claiborne groups (Hosterman 1984). Several archeological sites within the Manning outcrop contain pottery sherds. Perttula and Ellis (2013) have written about a number of archeological sites with ceramics that are found in the "Prairie Savannah" that lies just outside of the San Jacinto-Trinity River drainage basin (Gibbons Creek drains into the Brazos River), and just beyond and west of the traditional area of the Atakapa during the early Historic Period, as defined by Swanton (see map, Figure 4.1). Site 41GM281


37
59
81
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281
282
Gibbons Creek
58
181
201
205
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Brazos River
26
Rocky Creek
23
Piedmont
Quarries
Gravel Pits
Clay Pits
1 km

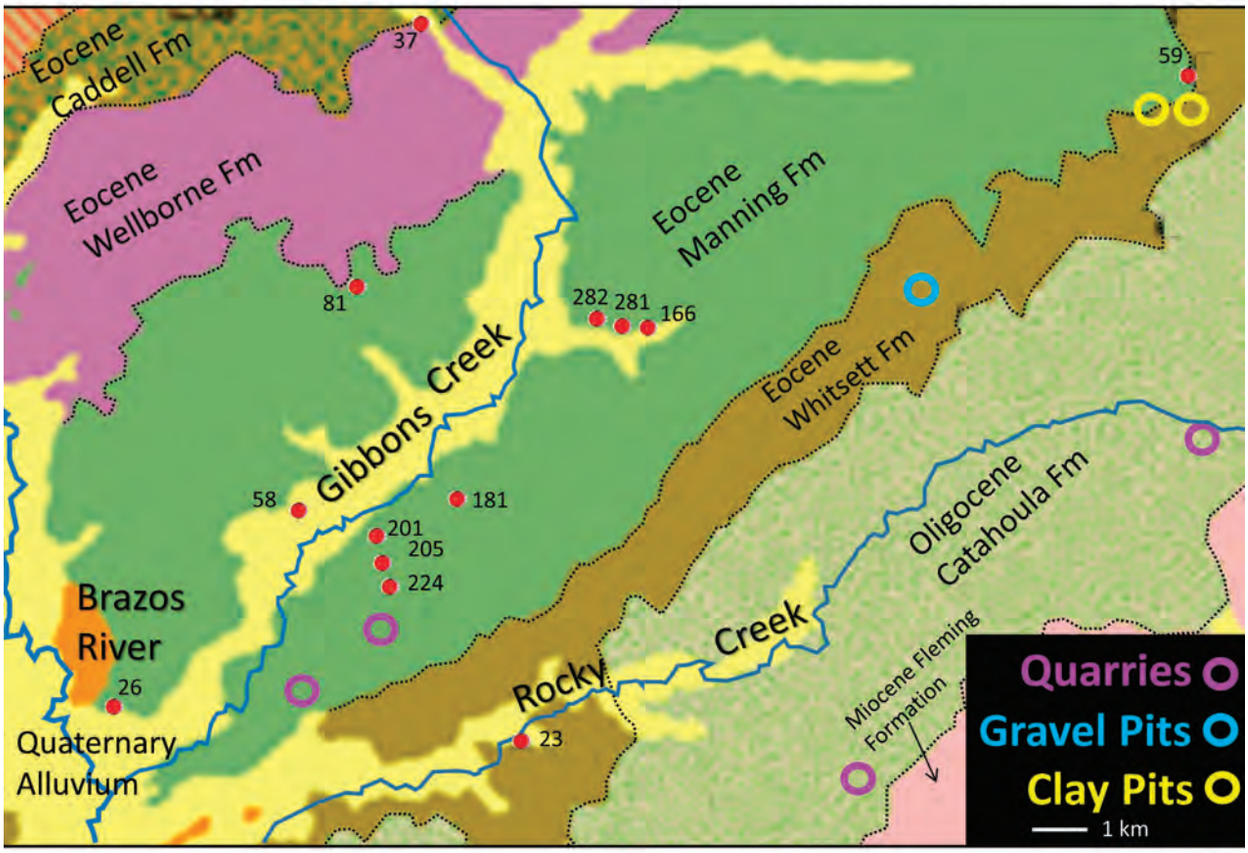

Eocene Caddell Fm
Eocene Wellborne Fm
Eocene Manning Fm
Eocene Whitsett Fm
Oligocene Catahoula Fm
Miocene Fleming Formation
Quaternary Alluvium
37
59
81
282
281
166
Gibbons Creek
58
181
201
205
224
Brazos River
26
Rocky Creek
23
Quarries
Gravel Pits
Clay Pits
1 km

Figure 9.1. Enlarged topographic map of the Gibbons and Rocky Creek areas, Grimes Country, showing archeological sites as well as modern quarries, gravel pits, and clay pits, for discussion of lithic procurement areas. See Atlas III, Frame 1 for location.

in the Gibbons Creek area (location 281, Figure 9.2) is one of these sites and lies within the outcrop area of the Manning Formation. Rogers (1995), who surveyed the archeology of the Gibbons Creek area, reported that over 25,000 artifacts of Late Prehistoric age were removed from this site, including 1,483 pottery sherds dated from AD 1160 to AD 1440. There was a mixture of ceramic types at this site, including some of Goose Creek and San Jacinto affinity that have been linked to early Historic Period Atakapan sites, as well as Caddo-type grog-tempered sherds.

The relatively large number of sherds at this site, in a hillside setting that has few qualities that would commend it for bison hunting but great resources of high quality ceramic-grade clay, as well as a number of burned rock hearths, suggests that Native American groups were making pottery here utilizing Manning ceramic clay and, perhaps, using local lignite as a heat source or even as an additive (temper) to the clay. Pearce (1932) noted the use of lignite for tempering in Caddo ceramics in Anderson County, and Mills (1950) noted the use of lignite and crushed shells as clay additives in Caddo pottery in Van Zandt County. Rogers (1995) reported that "the pottery of Gibbons Creek reflects an indigenous tradition [that] while exposed and influenced by outside contacts, maintained an identity of its own." He also noted that the Caddo-type grog-tempered ceramics were apparently not local, but "were obtained from trade or other types of contact with adjacent groups, while sandy paste and bone-tempered wares were produced locally." This suggests that people of the Trinity-Sabine Tradition (Akokisa and Bidai in the early Historic Period) were venturing slightly outside their normal area to make ceramics at this site.

Figure 9.2. Surface geologic map of the same area as the preceding figure. Geology taken from the Geologic At-las of Texas (U.S. Geological Survey, n.d.).

Regardless of the value of the Jackson-Catahoula-basal Fleming outcrop belt (Frame 1, Atlas III) as a resource for ceramic clay, for people of the Trinity-Sabine Tradition it constituted the nearest source of silicified wood outside of stream gravels. In particular, it contained a significant resource of large pieces ("logs") of silicified fossil palm and other woods.

It is perhaps not too fanciful to think that the location of this rich lithic resource may have influenced the decision of the Caddo to migrate significantly southward in the Late Prehistoric Period; the Hasinai Caddo moved south from Caddo centers in the Red River drainage area to an area on the Neches River within the outcrop belt of the Jackson-Catahoula (on former proto-Atakapa, "Mossy Grove" land) at that time (Story 1990; see discussion and maps, Chapter 11).

## Resources of the Pliocene Willis Formation

The Pliocene-age Willis Formation (highlighted as the red-brown area on Frame 1, Atlas III) contains deposits of gravels on hilltops, called "high gravels," left by the traces of old streams that rest unconformably on the mudstones of the underlying Fleming Formation. The gravels are resistant to erosion, hence their position on small hills. The Willis deposits—gravel, sand and silt—are iron stained, having been redeposited from the iron-rich underlying Middle Eocene Claiborne Group. In Montgomery, San Jacinto, Polk and Tyler counties the sandy and silty strata are brick red with iron stain, as are the dirt roads that traverse them in the classic East Texas Pineywoods. Iron-rich hematite constitutes part of the matrix of the coarse clastics of the Willis Formation and also occurs as pea-sized nodules. These hema-

tite nodules are so abundant that in many parts of East Texas they are used as road metal (Mathewson et al. 1985). The hematite nodules of the Willis appear to be the source of much if not most of the red ochre used by Southeast Texas peoples. Of two outcrop belts of Willis Formation (see Frame 1, Atlas III), the landward one is richer in hematite nodules.

Most Willis gravels are too small for projectile point fabrication, but locally they range to cobble size. In Montgomery County, along a tributary of the upper San Jacinto River called Lake Creek, are several archeological sites that range in age from Late Archaic through Late Prehistoric (location 2, Frame 1). These sites were surveyed by Bement and others (1987). Site 41MQ100 contained an outcrop of Willis high gravels where some of the clasts were cobble size, ranging to 8 cm in length. The cobbles consist of chert, quartzite, and silicified wood. The forested area is peppered with archeological sites that seem to be sites where lithic reduction activities had occurred, containing cobble fragments; primary, secondary, and tertiary flakes; biface fragments and arrow point preforms; and "burned shatter"—cracked and burned rock left behind from fires. Clayballs (used as heating elements for cooking) are common. Pottery sherds are found at most sites; sherds at sites 41MQ87 and 41MQ55 had red slip on outer surfaces, suggesting they may have been made on site using local hematite. The abundant evidence of lithic working suggest that Native Americans used the Willis area partly as a lithic procurement zone, although hunting in the adjacent Grimes Prairie was also likely a significant draw.

### River cobble resources

River cobbles of either chert or silicified wood are a predominant source for projectile points and lithic tools in this region. A cobble is defined as having a diameter between 2.5 and 10 inches, which is a good size for knapping. These cobbles are typically found in the point bar deposits of large rivers, such as the Colorado, Brazos, San Jacinto, Trinity, Neches, and Sabine (Frame 1, Atlas III). Each river has a different distribution of cobble lithic types, depending upon the lithology of the areas the river traverses. Each river also has a different fraction of cobbles as a proportion of the total sediment load and the distance (and gradient) travelled from its source.

The Brazos riverbed contains gravels and cobble gravels at least as far downstream as Brazos Bend State Park in Fort Bend County; the cobble-sized fraction typically occurs in the upstream terminus of point bar deposits in the river bed. Median grain size of sediments decreases downstream, however, so the small portion that is cobble size decreases markedly below about San Felipe State Park (Gustavson and Bullen 1996). These Brazos River cobbles are small and typically consist of chert carried from central Texas as well as silicified wood from Lower Tertiary strata upstream (Patterson 1993a).

The Colorado River carries a more diverse load including larger cobble sizes comprised of chert, limestone, and quartzite, with the bulk of the cobbles occurring above the town of Eagle Lake. Many of these cobbles consist of high quality Edwards chert of varying quality, sourced from outcrops along the Balcones Escarpment in central Texas. Most of the quartzite appears to have originated in the Rocky Mountains of New Mexico; it was eroded and transported to the Central Texas re-

gion by rivers in the Miocene and Pliocene, deposited as extensive "Uvalde Gravels" that also included Edwards chert and lesser amounts of silicified wood, limestone and sandstone. Those gravels were locally transferred to Pleistocene terrace deposits in the Colorado and Brazos rivers, where they ultimately were redeposited yet again as cobbles and gravel in Quaternary river alluvium (Stoutamire and McBride 2020). The Colorado River was a prime source for many cobble-made points and lithic tools made at Katy and San Bernard prairie sites, as mentioned in Chapter 8.

In contrast, the Trinity, San Jacinto, and Neches Rivers carry pebbles to small cobbles of quartzite and silicified wood eroded from Lower Tertiary sources (Patterson 1993a). Information from the Kyle Collection (Crook et al. 2017) is key to understanding the utilization of cobbles from these rivers versus other river and outcrop sources for lithic tools and points. In deep Southeast and East Texas locations along the Trinity, San Jacinto, and Neches rivers, Early Paleoindian points (primarily Clovis and Folsom) tend to be made of high-quality chert from the Edwards Formation, thought to have been brought to the area by hunters who came from central Texas (see discussion, Chapter 7). By the Early Archaic Period, some points were still made of high quality chert (either from central Texas or perhaps from Colorado River cobbles), but more utilitarian tools like scrapers, gouges, and net sinkers tended to have been made of local Tertiary cobbles of quartzite and silicified wood. Chert seems to have been obtained at a premium, because Crook and others note that most chert points of this era have been resharpened at least once. By the Late Archaic, most points in the Trinity River area were made from local, heat-treated quartzite from local river cobbles.

## Regional distribution of lithic materials and tools

### Lithic items that are part of the lithic reduction process

Some of the lithic items at archeological sites are intermediate products or side-products of the lithic reduction (tool manufacturing) process for making projectile points and tools. Some of these have been captured in the project database and can give an appreciation of where manufacturing of lithic items—especially points—occurred. Five such lithic reduction tools and manufacturing by-products are defined here and their distributions are mapped: chert cobbles, chert cores, lithic flakes, chert preforms, and hammerstones.

**Chert cobbles.** A plot of chert cobbles from sites documented in the project database shows that chert cobbles at archeological sites are mainly found in the inland San Bernard and Katy prairie hunting areas, near to their presumed sources in the Colorado and Brazos rivers (Frame 2, Atlas III). Patterson (1996) and Crook and others (2017) observed that most large projectile points found in the Paleoindian and Archaic Periods, and many of those found in younger periods, are made from chert.

Chert cobbles, the raw material for the great majority of these points, are heavy and difficult to transport. Their concentration in the Katy and San Bernard prairie hunting zones underscores the fact that these sites are both close to the source of chert cobbles in the Colorado and (to a lesser extent) Brazos rivers, and the fact that the Katy and San Bernard prairie hunting sites are some of the most important

places where the points are used—in killing bison. Circled in Figure 8.39 of the previous chapter are locations in the San Bernard Prairie where chert point manufacture occurred—as evidenced by chert cobbles, preforms, cores, and large flakes; these locations are essentially the same locations shown for cobble presence in that area in Frame 2. Also present at those same sites are numbers of bifacial knives used in skinning bison, which are shown in Figure 8.39; this was an area where bison were harvested and where people tooled up for the kills.

Notably, chert cobbles as well as "cores" made from chert cobbles (discussed next) are relatively absent in the coastal zone, as can be seen in the map. Being heavy, they were not transported without good reason. As was discussed in Chapter 6, most coastal sites show little evidence of lithic point manufacture other than resurfacing and repairing existing points (e.g., Crook et al. 2017).

An unusual site with chert cobbles is at HR365 in western Harris County (location 1 on Frame 2), which contained a cache of chert cobbles (and little else) that had been buried by its owner and was never recovered; the cobbles were apparently in the act of being transported when cached (Moore 1995). Most other cobbles are found at sites where they are associated with debitage (flake debris) as well as other evidence of tool and point manufacturing.

**Chert cores.** A core is what is left when a number of lithic flakes are taken from a piece of chert (typically in this region, from a cobble); the flakes were to be used as cutting tools of various types. A chert blade core of Clovis affinity from the Woods Springs site (41LB15; location 1 on Frame 3, Atlas III) is displayed in Figure 9.3. It is one of three chert blade cores found to date at that locality, and trace element geochemistry analysis (using X-ray fluorescence) shows that all three are made of Edwards chert (Crook 2017a). It may have been carried from central Texas; typically, Clovis era hunters are considered to have been widely travelled. Alternatively, it could have come from an Edwards chert cobble carried in the Brazos or Colorado river.

Figure 9.3. A Clovis-era (Early Paleoindian) Edwards chert blade core from the Wood Springs site, Lib-erty County. Kyle Collection; photo courtesy of Wilson W. Crook, III.

Cobbles were often only partially reduced on site into cores to reduce carrying weight (the outer weathered "cortex" was flaked off), and were carried to other sites for further lithic reduction (Patterson 1996). The general distribution of cores (Frame 3) reflects that of cobbles, and they are found principally in western prairie sites, but the cores are more extensively distributed and are found at more sites, probably reflecting their preferred use over that of full cobbles for travelling. Most chert cobbles appear to come from the Colorado and Brazos rivers. Those in the Willis outcrop belt appear to have come from cherts sourced within the Willis Formation, where they were being reduced, as discussed.

In the nearby Katy Prairie, two campsites on the flanks of Pool Hill on the rim of the Brazos (41FB95 and 41FB198) near the Late Archaic burial ground at the Bowser site (41FB3), were sites of extensive point and tool manufacture, as evidenced by a number of chert cores, preforms, abundant chert flakes, quartzite hammerstones, and finished chert dart points (location 2, Frame 3; Patterson and Hudgins 1987, 1991). The lithic materials probably came either from upstream on

the Brazos River or from the nearby Colorado River.

**Large lithic flakes.** The further reduction of cores into projectile points produces lithic flakes, as does later re-sharpening of points and lithic tools after use. Larger flakes tend to be produced earlier in the process, when the points (especially the larger dart points) are first fashioned (Patterson 1990). Large flakes are also made as an end product, to be used as cutting tools. Large numbers of lithic flakes indicative of the early stage, "primary" reduction of cobbles are typically found where the cobbles are also found: in San Bernard Prairie hunting camps (location 1, Frame 4, Atlas III), and on the Katy Prairie at western Buffalo Bayou at the Barker and Addicks reservoirs (location 2), White Oak Bayou (location 3), and Cypress Creek (location 4). These were all very important sites for communal hunting of bison and deer, as noted in Chapter 8. On the map, red circles indicate sites where more than 500 large lithic flakes (defined as flakes greater than 15 mm in size) were found. Clearly, Native American people brought chert cores to these long-occupied Early Paleoindian through Late Prehistoric hunting sites and fabricated points from them there, perhaps in preparation for the fall hunts, or perhaps after hunts, while others were engaged in hide preparation and meat drying.

Figure 9.4. A Clovis-era overshot flake, of Edwards chert, from the Wood Springs site (41LB15), Liberty County. Kyle Collection; photo courtesy of Wilson W. Crook, III.

As seen in the distribution of these flakes, some chert material was getting to the San Jacinto, Trinity, and Neches rivers and was used in making tools or points. A large chert flake from the Woods Spring site of Liberty County, near the Trinity River (Figure 9.4; the Wood Springs site is at location 7, Map 4), is one of several recovered there. These flakes were analyzed by X-ray fluorescence and determined to have been sourced from Edwards Formation chert (Crook 2017b). A display of Edwards chert flakes from the Woods Springs vicinity is shown in Figure 9.5, from Crook and others (2017). Note that one of the flakes, second from the right in the bottom row, was clearly part of a cobble, as its weathered, light colored cortex (outer layer) is showing. The nearest supply of Edwards chert cobbles is the Colorado River.

Figure 9.5. A collection of Edwards chert flakes from the Wood Springs site (41LB15), Liberty County. Kyle Collection; photo courtesy of Wilson W. Crook, III.

At least two sites in the coastal zone contained a large number of large flakes, as shown on the map. However, the size of flakes was not typically noted in the database for the coastal zone (hence the green color of the dots on Frame 4), so little can be concluded from that, except that the much lighter weight of large chert flakes facilitated wider distribution into areas lacking cobbles, potentially via trade (see later discussion).

A cluster of sites (location 5) in the northwestern part of the study area at the

Gibbons mines sites in Grimes County are related to point and tool production from lithic sources in the Jackson-Catahoula, as already discussed. While scant site descriptions leave much detail to be desired, it appears from sites like 41GM23 that large pieces and even logs of silicified wood that are found in the Manning and Whitsett formations were being used as lithic raw material. In like manner, a number of sites located on the hillside outcrop edges of the Willis (location 6) seem to indicate that cobbles found on the outcropping edge of Willis high gravels were being reduced more or less in situ.

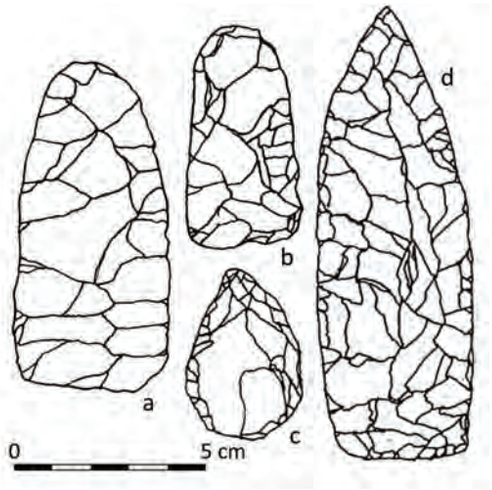



Figure 9.6. Examples of chert pre-forms. a–c, from 41WH19 in the San Bernard Prairie (Patterson et al. 1987). d, from the Owens site (41HR315), Cypress Creek (Patterson 1980).

**Chert preforms.** Chert cobbles used for making large bifacial knives or dart points were selected for shapes that could, with some flaking, yield roughly cut, slab-shaped blanks or preforms, from which the desired end products could be made by further careful lithic reduction (Figure 9.6 shows examples, from site 41WH19 in the San Bernard Prairie (Patterson et al. 1987), and from the Katy Prairie, site 41HR315 along Cypress Creek (Patterson 1980). As such, they are an intermediate product, lighter to transport than a cobble, and a well-made preform has a higher probability of resulting in a usable point than a simple chert cobble. For those reasons, one would expect to see preforms in the usual lithic manufacture sites on the Katy and San Bernard prairies, but perhaps also in other places where these intermediate products are brought for use. Frame 5 shows a high concentration of large chert dart point preforms in the Katy and San Bernard sites, but also a number of them in the lithic-poor coastal region. This indicates that coastal people were obtaining preforms to make their own points. Perhaps they traded for the preforms, or perhaps they brought these home from extended hunting trips on the prairie.

**Hammerstones.** Hammerstones are made primarily of quartzite or less frequently of a silicified limestone from central Texas. Both lithic types are found in the Colorado River, as mentioned (Patterson 1996), but also came from quartzite cobbles in the paleo-stream deposits of the lower Willis Formation, as shown in Map 6. Figure 9.7 is an example of one from a Liberty County site. Hammerstones are important tools for lithic reduction—typically involved at the primary reduction of a cobble into cores and flake blanks—and these hammerstones are found primarily in the western part of the area, in the Katy and San Bernard prairies. The map shows that hammerstones are much less frequently found in the coastal zone, again suggesting that much less primary lithic reduction was taking place there. Their scant occurrence in the rivers of the Eastern Texas Forest is probably more a result of collection choices rather than reality, as there are quartzite cobbles (eroded from the Willis Formation) carried in the stream beds of the Trinity and other East Texas rivers. Most of the sites along the lower Trinity River—those represented in the Kyle Collection—are from surface collections, and one would suspect that unimpressive lumps of quartzite might not often be picked up. Much the same could be said of other lithic items like lithic flakes or grinding stones (discussed later); we suspect that the Trinity River area is subject to lithic material sampling bias due to its dependence

Figure 9.7. A quartzite hammerstone from Liberty County. Kyle Collection; photo courtesy of Wilson W. Crook, III.

Figure 9.8. Heat-treated lithic items, Liberty County. Kyle Collection; photo courtesy of Wilson W. Crook, III.

upon surface collections.

**Heat treating of chert.** Chert is often tough and difficult to work, and heat treating of chert blanks was commonly done early in the lithic production process (Patterson 1996). Placing chert in a wood fire significantly lowers the tensile strength of the chert, making it easier to work (Purdy and Brooks 1971; Patterson 1981, 1996). Heat-treated chert has a waxy luster that is evident on the surfaces of blanks, and hence on the points and tools made from those blanks—or at least on the outer portions of them. Heating oxidizes whatever iron is in the chert, which often lends chert pieces a reddish color. Figure 9.8 shows a variety of items from Liberty County that reflect the effects of heat treating. Because heat treating occurs early in the process of lithic reduction, it often takes place at the site of lithic procurement. For example, a number of lithic reduction sites mentioned at the Gibbons Creek lignite mine area (location 1, Frame 1, Atlas III) include hearths where cracked rock shows that heat treatment was occurring. Heat-treated chert was then shaped by flaking to produce dart or arrow point preforms that could be taken to more permanent sites for final reduction and sharpening.

## Lithic Tools

Lithic tools discussed here can be divided into two types: chipped stone tools, made by flaking of chert, quartzite, or silicified wood; and ground stone tools, usually made from sandstone, for grinding of stone items, bone, shell, and plant seeds.

**Chipped stone tools.** Chipped stone items such as lithic scrapers, gravers, and knives are found in both inland and coastal zones, even though from the preceding discussion it appears that most lithic reduction of large items occurred inland. These tool items would mostly have had to be imported to coastal zone sites.

Lithic scrapers were used in preparing hides, among other tasks; hence the large numbers of them in the Katy and San Bernard prairies, where they were indispensable. They were equally indispensable on the coast (Frame 7, Atlas III). As was dis-

cussed in Chapter 8, bison remains at coastal sites show that bison were hunted along the coast, and Spanish visitors noted that Akokisa and Bidai dome-shaped "huts" were covered with bison and other animal skins, which had to be scraped clean when fresh, with scrapers such as those shown in Figure 9.9, from the Trinity River area. Chert, quartzite, and silicified wood were used; the scraper on the right of that photo is made from locally sourced silicified wood. In coastal sites, sharpened oyster shells were also used for this task, as mentioned in Chapter 6.

Figure 9.9. Some "turtleback"-shaped scrapers from the Wood Springs site, Liberty County. The one on the right is made from locally sourced silicified wood. Kyle Collection; photos courtesy of Wilson W. Crook, III.

Another necessary task in preparing skin-covered housing is sewing the skins together, and for that, holes needed to be punched or drilled through tough, thick hides to allow rawhide thongs to be used for sewing. Drills with sharpened edges could be put to this task, or to drilling holes in shell ornaments or fishing net sinkers. Figure 9.10 shows several of them, including one on the left made of silicified wood. Sharpened bone awls could also be used for puncturing leather where stone was scarce, such as the bone pins shown in Figure 11.4. Gravers are small chert flakes with a sharp protruding spur, typically used for inscribing bone or other materials (Figure 9.11A).

Prismatic knife blades could be made by knapping long flakes off large chert cores like the core shown in Figure 9.3. Several such knives are shown in Figures 9.11 and 9.12; their prism-shaped blade edges are long and sharp due to the flaking process. Other knives were bifaces, made by further reduction of large preforms. Examples from hunting areas of the San Bernard Prairie are shown in Figures 8.42 and 8.43.

**Ground stone tools.** Hematite is transformed into powdered red ochre for paint by grinding it, for example by using two opposing grinding stones. In Southeast Texas, where corn agriculture was not typically practiced before the Historic Period, grinding stones are usually smaller and more rudimentary than the large, trough- or concave-shaped metates (grinding slabs) and manos (handheld grinding devices) used for grinding corn that are typical in, for example, desert Southwest Late Prehistoric settings (e.g., see Adams 1999). Sandstone that is hard and tough enough for grinding is scarce in the coastal region, and the hardest local sandstone seems to be that found in fracture zones transecting the soft sandstone of the Catahoula Formation, mentioned earlier. These fracture zones typically contain thin (<5 cm) silicified sandstone slabs, yielding relatively small sandstone pieces. Figure 9.13a shows a hand-sized mano from Liberty County (from Crook et al. 2017).

Figure 9.10. Late Prehistoric drills from Liberty County. Drills like these would have been hafted onto a stick, and spun by hand or with a bow. Kyle Collection; photo courtesy of Wilson W. Crook, III.

Several small manos and larger stone metates from the Bowser site (41FB3) in Fort Bend County contain red ochre stain, leaving little doubt that they were used

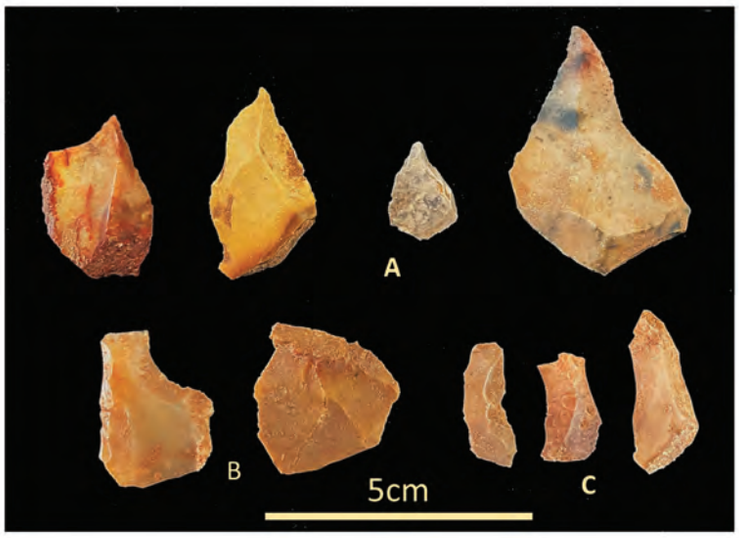



Figure 9.11. Small chert lithic tools from the Late Archaic Bowser site (41FB3), Fort Bend County. A = gravers and drills, B = scrapers, C = blades.

in grinding pigment. A small, slab-shaped metate from that site (Figure 9.14e) has a small, rounded hollow that may have been used to receive a small grinding stone mano like the one pictured in Figure 9.14d, which is ochre-stained. Other sandstone artifacts have depressions that may have been useful for processing pecans or acorns. The depressions of such "nutting stones" protect the meat of the nut from being crushed during cracking of the shell (Figure 9.13b).

Frame 10, Atlas III, shows the distribution of sandstone metates and manos (grinding stones) that were noted in the project database. They are found in two general areas: first, in the hunting areas of the San Bernard Prairie (location 1), in the Katy Prairie at upper Buffalo Bayou at the Barker and Addicks reservoirs (2) and at Cypress Creek (3); and second, near the outcrop edges of the Willis Formation (locations near 4), where as discussed, lithic reduction activities and probably grinding of red ochre were occurring. Wheat (1953) described nodular red hematite and its yellow (reduced) form, limonite, in association with grinding sandstones at the Addicks Dam sites on the Katy Prairie (location 2), and a number of sandstone pieces at the Bowser site (location 5) show red ochre staining, as mentioned. The sandstone itself is thought to be primarily from the Catahoula Formation (the orange band on Map 10) and had to be brought in to all these sites.

Sandstone metates are not typically found in the coastal zone, suggesting that powdered red ochre (see next section) might have been a trade item for coastal people, and hence that the use of manos and metates in the Willis outcrops might partly have been for use in trade. Cabeza de Vaca, while living with coastal Atakapans and Karankawans on the island of "Malhado"—probably modern Follett's Island to the southwest of Galveston Island (location 6) according to Weddle (1985; see Chapter 4)—went on trading trips to the interior to trade seashells, pearls, and other coastal items for buffalo hides and red ochre from the interior (Chipman 2010). The relative absence of metates and manos on the coast as well as their relatively small size suggests that their use may have been more for tool making and red ochre pulverization than, as was suggested by Patterson (1996), for grinding of grass seeds and other vegetative materials. For whatever reason, early people did not seem to take

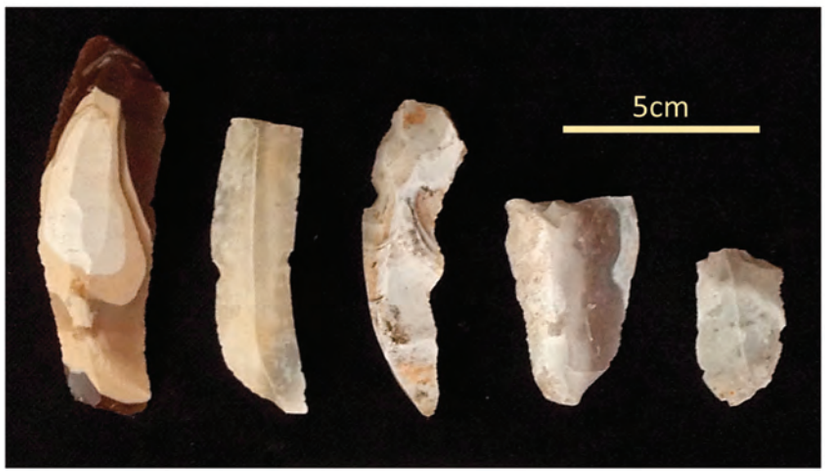



Figure 9.12. Prismatic chert knives from Liberty County. Kyle Collection; photo courtesy of Wilson W. Crook, III.

Figure 9.13. a = Middle Archaic hand-sized grinding stone (mano), Wood Springs site, Liberty Coun-ty. b = nutting stone, for cracking acorns and nuts (Crook et al. 2017). Kyle Collection; photo courtesy of Wilson W. Crook, III.

the trouble to transport many of them from sandstone outcrops of the Catahoula Formation in the north to the coast.

### Other mineral items

**Red Ochre.** Red ochre pigment is found both in inland hunting sites and in sites of the coastal zone (Figure 9.14). Its Native American uses were varied. Ancestral Atakapans at the coastal Mitchell Ridge (location 1, Map 10) and Caplen Mound (location 2) sites used red ochre in burial practices, as evidenced by red ochre stains on bones and on shell artifacts (Ricklis and Black 2019; Taylor and Dial 2019). An Atakapan speaker recorded by ethnologists recalled their use of red paint:

> *They went almost naked. Men and women wore their hair long, and the men did not wear beards. They danced painted with red and white paint and, when relatives had died, with black paint and with feathers on their heads, sounding a rattle at the dancing place.* (Gatschet and Swanton 1932)

Such a scene of people (and a dancer) using red ochre as a facial ornament is depicted in the painting of Alexandre DeBatz from 1735 (Figure 4.2). Other coastal groups in the southern United States used red ochre as a body coating in everyday life, not just ceremonially, and the Atakapa and Karankawa may have as well. Like these groups, the Native Atakapans were typically nearly naked in summer months, save for breechcloths for men and moss skirts for women (Aten 1983). Native American Virginians in early historical times

> *wore no artificial protection for their bodies, but . . . so painted and ochred were their bodies, legs, and arms, with red, black, white, yellow and vermillion stripes, that . . . these primitive men-at-arms appeared to have on stockings and doublets.* (Jones 1873).

Such use may have benefitted users as a photoprotective ointment, as hypothesized by Rifkin and others (2015) for red ochre users in the South Africa Neolithic. Hernando de Soto, when visiting Native groups in 1540 in what is now the southern United States, noted the use of red ochre as a coloring in leathers: "The skins are well-dressed—the color being given to them that is wished—and in such perfection that when of vermillion they look like very fine red broadcloth" (Jones 1873). Just

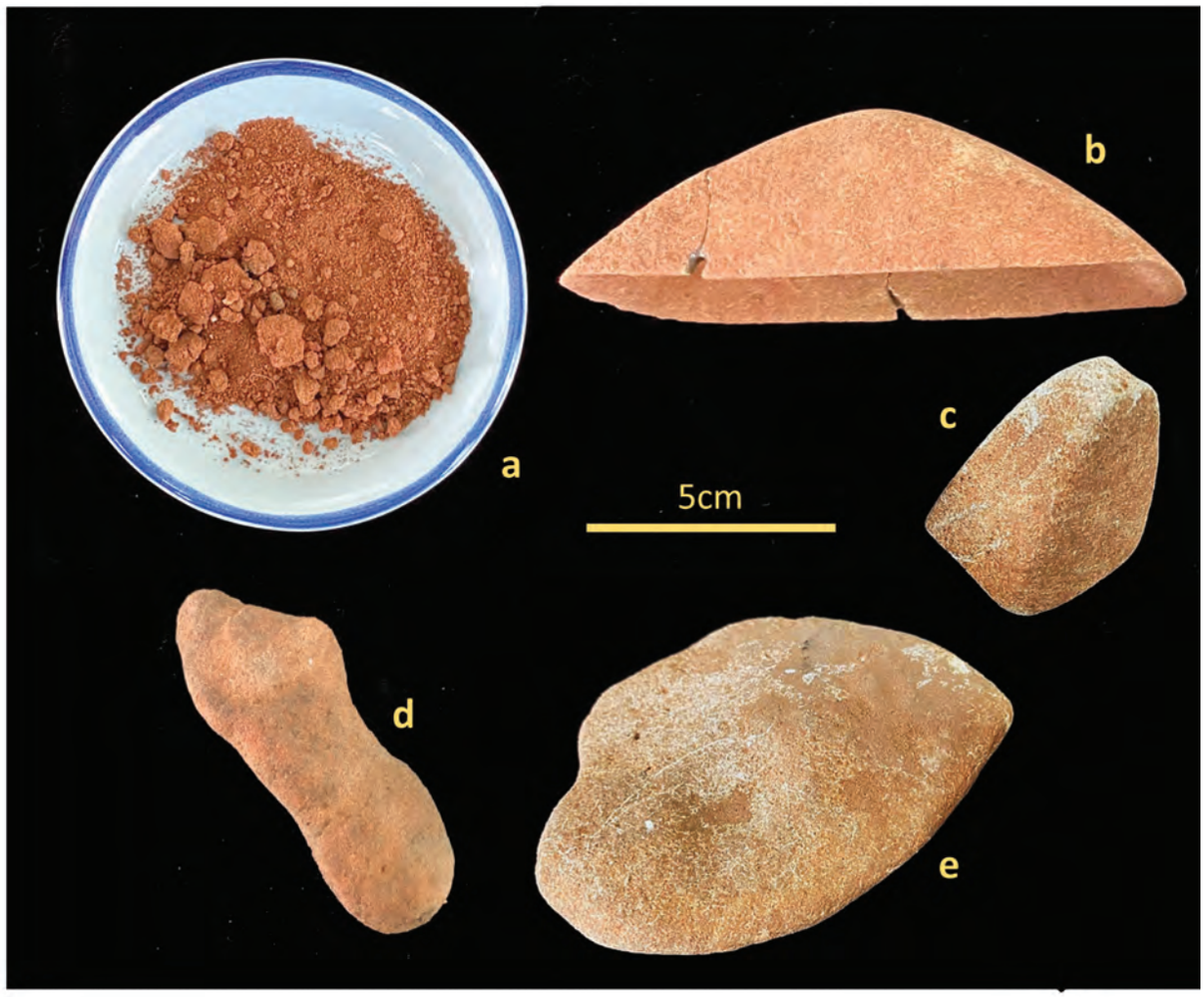



Figure 9.14. Ground stone items and red ochre. a = Pulverized red ochre (in modern dish) from a burial at the Bowser Road site (41FB3), Fort Bend County. b = Sandstone boatstone, within and around which the red ochre was found. c = Another sandstone boatstone (shown inverted) from the site; both were produced by grinding against pieces of relatively soft sandstone. d = is small sandstone mano with red ochre staining. e = small sandstone metate with a small hollow area resulting from grinding. All the sandstone items are made from local Catahoula sandstone. The site was excavated in 1997 by Patterson and others (1999). From the Larry and Margie Bass collection.

such a finely produced skin with an application of red ochre and (perhaps) carbon black on the underside was painted by de Batz in 1735, as shown in Figure 4.12. Rifkin (2011) also noted the efficacy of red ochre as a hide tanning agent.

In Southeast Texas the major source of red ochre material is in the hematite that is abundant in the outcrops of the Willis Formation, as discussed earlier. Red hematite nodules, approximately the size of peas, weather out of the outcrop in such numbers that they are used as road material (Mathewson et al. 1985). The outcrop belt of the Willis is highlighted on Frame 11, Atlas III; it stretches across the northern third of the study area. Inland groups had ready access to large quantities of easily harvested and transported red ochre, which accounts for its common occurrence in archeological sites of Southeast Texas.

Wheat (1953) described nodular red hematite and its yellow (reduced) form, limonite, at the Addicks Dam sites that he explored (locations at 3, Frame 11). Other pieces of red ochre that he found there were more tabular in form, like red sandstone. As mentioned earlier, red stain occurs in the sandy matrix of Willis Formation high gravels, and nodular hematite is the more usual form. These tabular red ochre pieces were found near a grinding sandstone, suggested that the introduced hematite was being ground into a powder for use there. Evidence of powdered hematite (red ochre) was found inside a ceramic bowl at the Jameson site in Liberty County (location 4; Aten 1967). Figure 9.14 shows a small amount of pulverized red

ochre that was found next to a (probably ceremonial) boatstone at a Late Archaic burial site in Fort Bend County (41FB3). Found nearby were small sandstone pieces with rounded edges and red ochre stain (one of them is item d in that figure); these were likely used to grind red ochre into powder, on a larger sandstone metate.

**Asphaltum (bitumen).** While not a lithic material per se, asphaltum (petroleum bitumen) is a mineral that is extracted in a viscous state as globules that wash up on the beaches from offshore; it issues from natural petroleum seeps on the seafloor. Native Americans used asphaltum to decorate pots (the Karankawa's Rockport ware, Figure 8.38) and, perhaps more significantly, as an adhesive for hafting points. For example, a stemless unifacial arrow point found at site 40WH73 (location 1, Frame 12, Atlas III) has asphaltum at its base, attesting to the occasional use of asphalt in hafting (Patterson and Hudgins 1992). Asphaltum hafting was encountered on the bases of numerous points excavated at the Jameson site in Liberty County (location 2; 41LB02, Aten 1967). Asphaltum was used for affixing socketed deer bone projectile points to reed or wooden shafts, as three bone points in the photograph of Figure 6.11 show. Asphaltum was used as a hafting adhesive as far back as Neanderthal time in the Old World, where it was also used to line and waterproof baskets and, later, to fix broken pots (Connan 1999).

Figure 9.15. Small pieces of asphaltum, from a burial at the Bowser Road site (41FB3), Fort Bend County, excavated in 1997 (Patterson et al. 1999).

The distribution of asphaltum (Frame 12) shows that it occurs as expected along the coast, but that it is also found far inland, especially in the inland prairie hunting and lithic reduction sites. Figure 9.15 shows a few pieces of it that were excavated at the Bowser (41FB3) burial site in inland Fort Bend County (Patterson et al. 1999). Asphaltum is widely encountered across the northern Gulf of Mexico coast to this day, as tar "blobs" that emanate from natural subsea seeps and wash up on beaches. In 1720 French explorer Captain Jean Béranger observed "great chunks" of dried tar on the beach at San Jose Island, near modern Port Aransas, and may have used it to repair his ship. Two centuries earlier, Spanish explorer Hernando de Soto used Gulf tar blobs to repair his own ships (Weddle 1991: 218).

Around the former town of Port Austin, which was located on the south shore of Tres Palacios Bay in Matagorda County in former Karankawa territory, there was an onshore seep of petroleum, which contained

> *a combustible substance, which had been on fire for several years, emitting smoke and shining at night into great distances. From this burning ledge particles are detached by the action of waves and a substance like gum or pitch is thrown ashore, which is called cheta by the Spanish people. The Indians are fond of masticating it.* (Gatchet 1891)

A Mrs. Oliver, who grew up at Port Austin, noted that asphaltum was often washed ashore, and that the Karankawa Indians used it for black paint after mixing it with oil (Gatchet 1891).

**Exotic, far-travelled lithic items.** A number of exotic lithologies such as gale-

na, quartz crystals, and ornamental copper have been found in the area, typically associated with Late Archaic burials. These materials are not found naturally in the Gulf Coast region and were brought in by Native Americans from long distances. They are described in Chapter 11.

## Summary

A summary map shows all archeological sites of the database that contain evidence of significant lithic manufacturing activity in the form of significant numbers of chert cobbles, chert cores, or hammerstones (Frame 13, Atlas III). There are of course many other such lithic production sites, but these sites show the clearest evidence of significant lithic production. The production of lithic tools and projectile points can be characterized by three zones, as labelled on the figure; these closely mirror the geologic zones from which the lithics were procured:

*The Jackson-Catahoula belt* was the source of silicified wood, hard sandstone and ceramic-grade clay. The Gibbons mine sites (location 1, Frame 13) are typical and show evidence of lithic reduction at hillside campsites, as discussed. Evidence of lithic reduction is in the form of lithic flakes, hammerstones, partly formed tools, and burned rock hearths suggesting heat treatment of flakes. Eocene silicified wood—especially palmwood—from local outcrops was being used to fashion lithic tools.

*Hillside gravels of the Willis Formation* locally contain cobble-sized clasts of chert, quartzite, and silicified wood cobbles that were used for lithic reduction. Various production sites along Lake Creek and Mound Creek (location 2) are typical, as discussed. Small hillside sites pepper the area and show cobble fragments; primary, secondary and tertiary flakes; biface fragments and arrow point preforms; and "burned shatter"— cracked and burned rock left behind from fires. The Willis Formation was also a major source of hematite nodules used for red ochre.

Cobbles of abundant silicified wood with lesser amounts of chert and quartzite that erode from the Willis and Jackson-Catahoula belts find their way into the streams and rivers of the area and are transported downstream. Several inland sites show working of these cobbles more or less in situ in downstream locations. At the Jamison site in Liberty County (location 3), locally formed arrow and dart points contain both chert and silicified wood, and silicified wood is a source of the majority of Late Prehistoric arrow points of the Trinity-Sabine Tradition found thereWW. There is an apparent geologic limit to the downstream transport of these cobbles; places downstream from the Jamison site lack cobbles of sufficient size for lithic reduction.

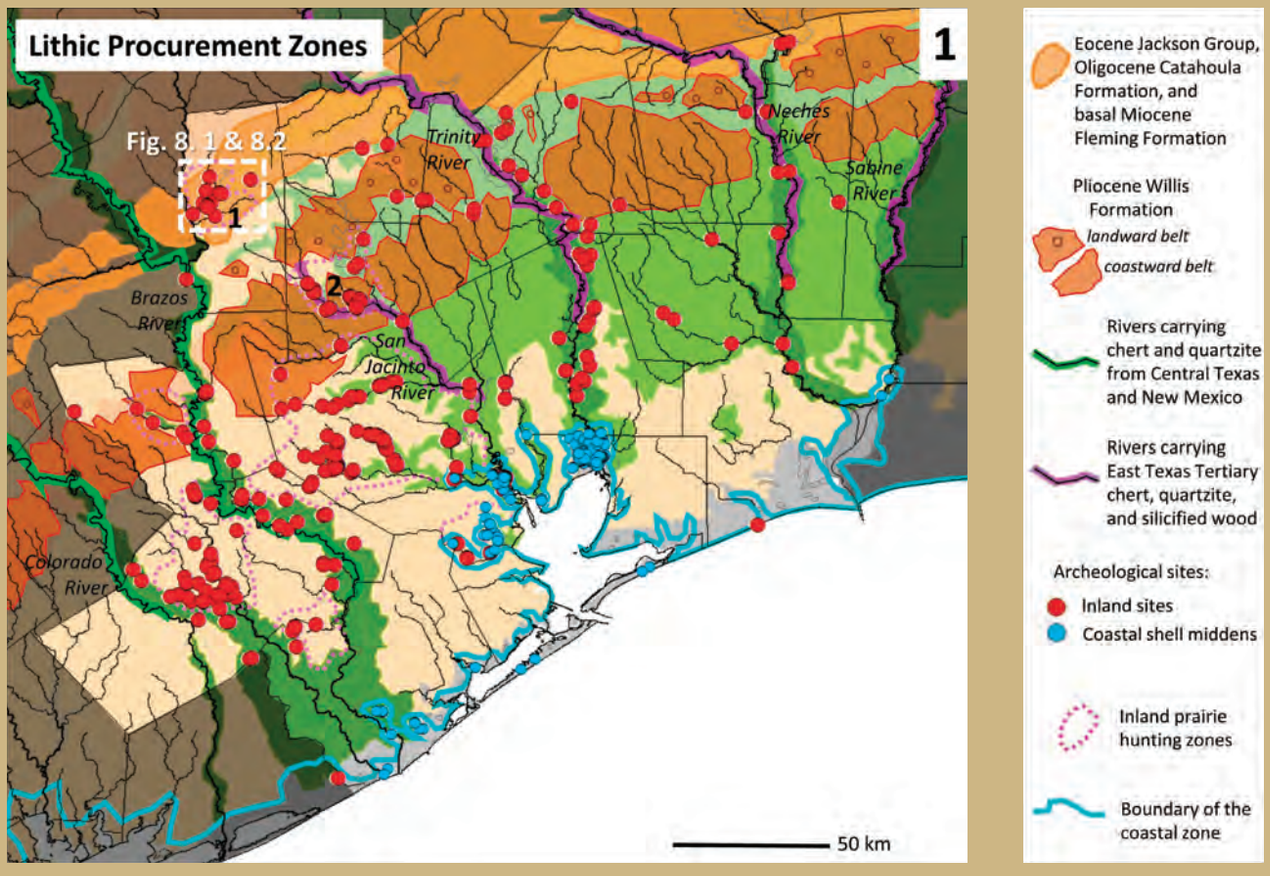
*Chert cobbles taken from the Brazos and Colorado rivers* were used in lithic reduction workshops in the southwestern part of the area, both in sites directly along those rivers as well as in hunting camps of the area, to which the cobbles were transported. A typical site is the Goloby site (41WH03) in Waller

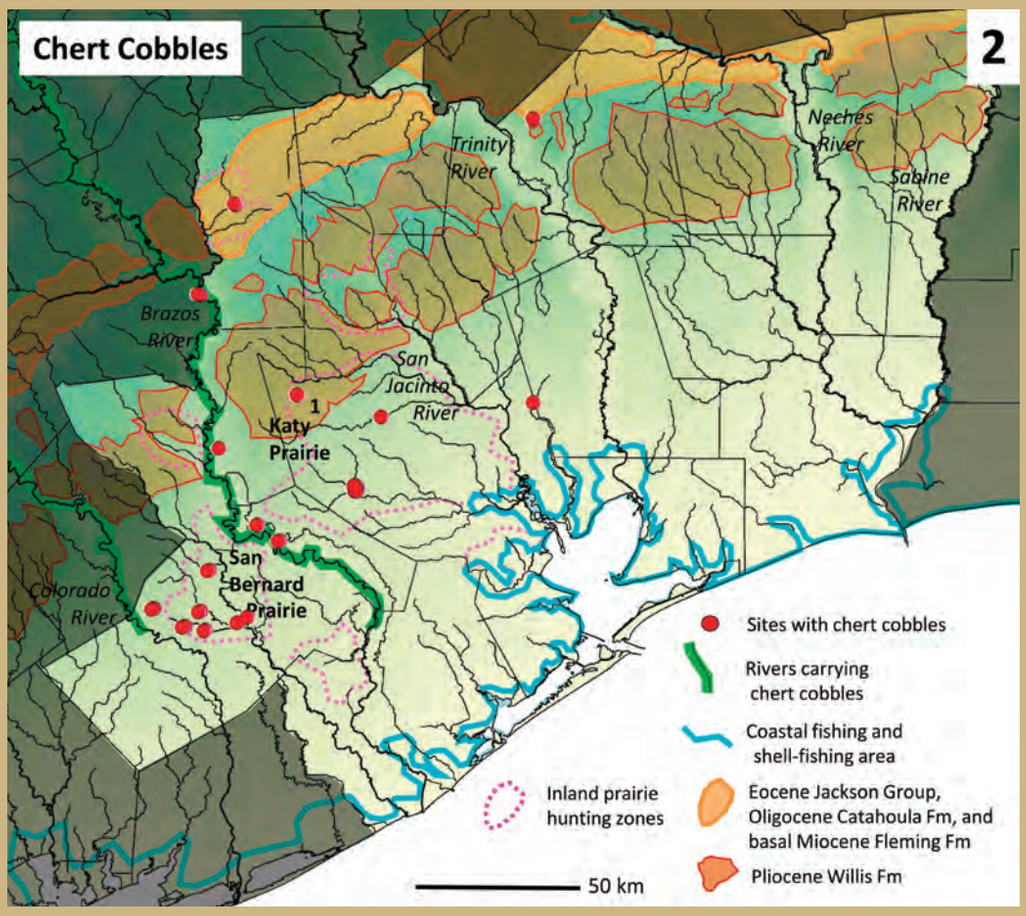
County, on the bank of the Brazos River (location 4; Patterson et al. 2003). A long-occupied site from the Late Paleoindian through Late Prehistoric periods, it sprawls over a large area. Evidence of manufacturing activities includes chert cobbles and cores, chert hammerstones, large numbers of lithic flakes of various sizes, dart point preforms, and prismatic blade cores. The chert predominantly used is brown chert from a local Brazos River source.

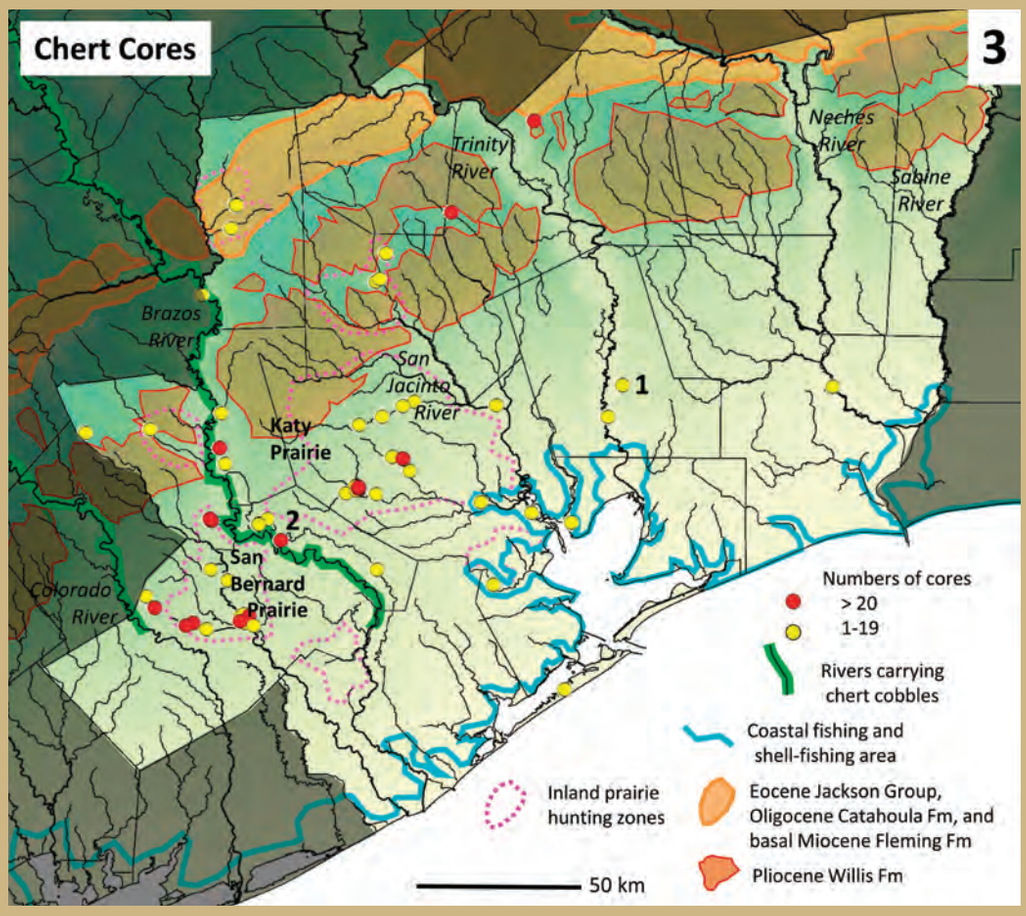
Several aspects of the distribution of lithic and shell items suggest the movement of goods, either by trade or by seasonal migration of people. Asphalt is gathered on the coast and is found widely distributed inland. Red ochre sources are found in the inland Willis Formation, and ochre products were widely distributed in both inland and coastal regions. Ethnohistorical accounts suggest that trade from inland sites was at least partly the means of distribution. Lithic tools like scrapers, gravers, knives, and lithic points were produced at inland sites and distributed to coastal sites. Coastal-sourced marine shells are widely found inland as both tools and ornaments of the Late Archaic Lower Brazos Culture (see Figures 11.5-11.9 and accompanying discussion, Chapter 11). Ornamental use of marine shells in areas of seasonal nut gathering, coupled with ethnohistorical accounts, suggest that coastal people wearing shell ornaments seasonally migrated to these sites.

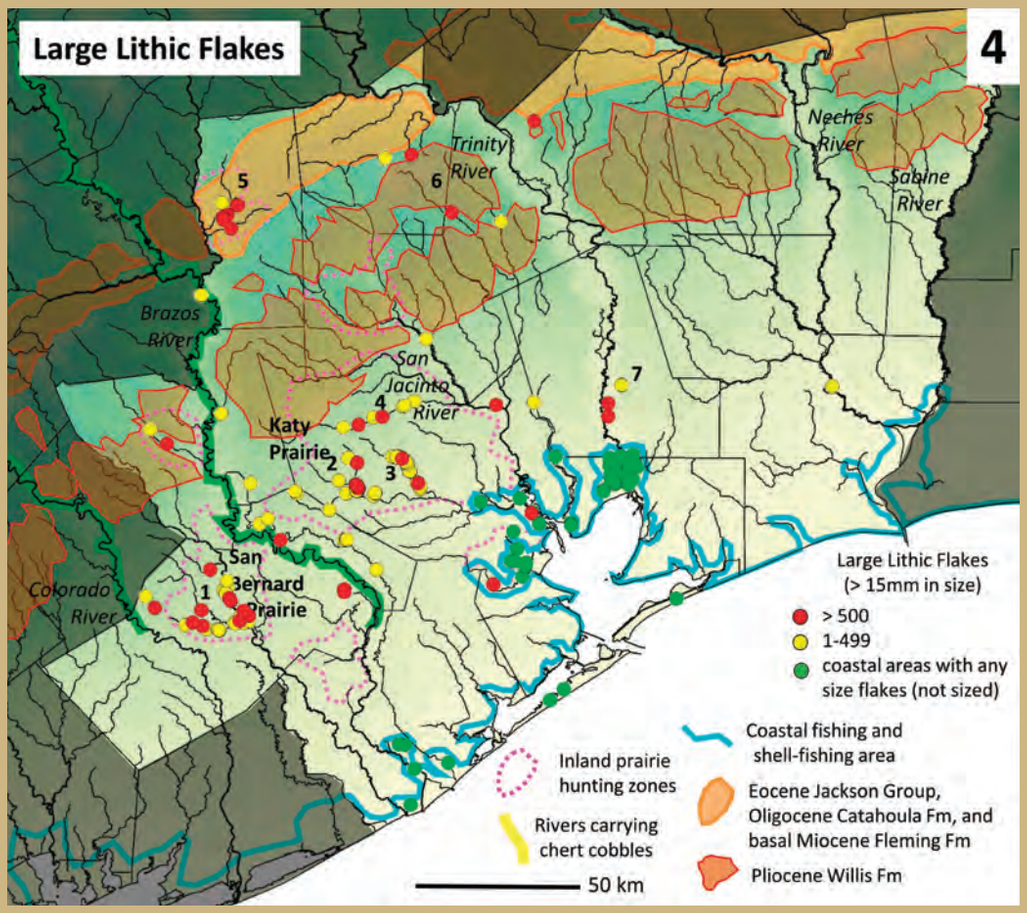
As mentioned earlier, Cabeza de Vaca, as a representative of coastal people, traded coastal shell material and tools for inland red ochre and hide (see preceding discussion). Presumably asphalt would have been traded to inland sites in the same way.

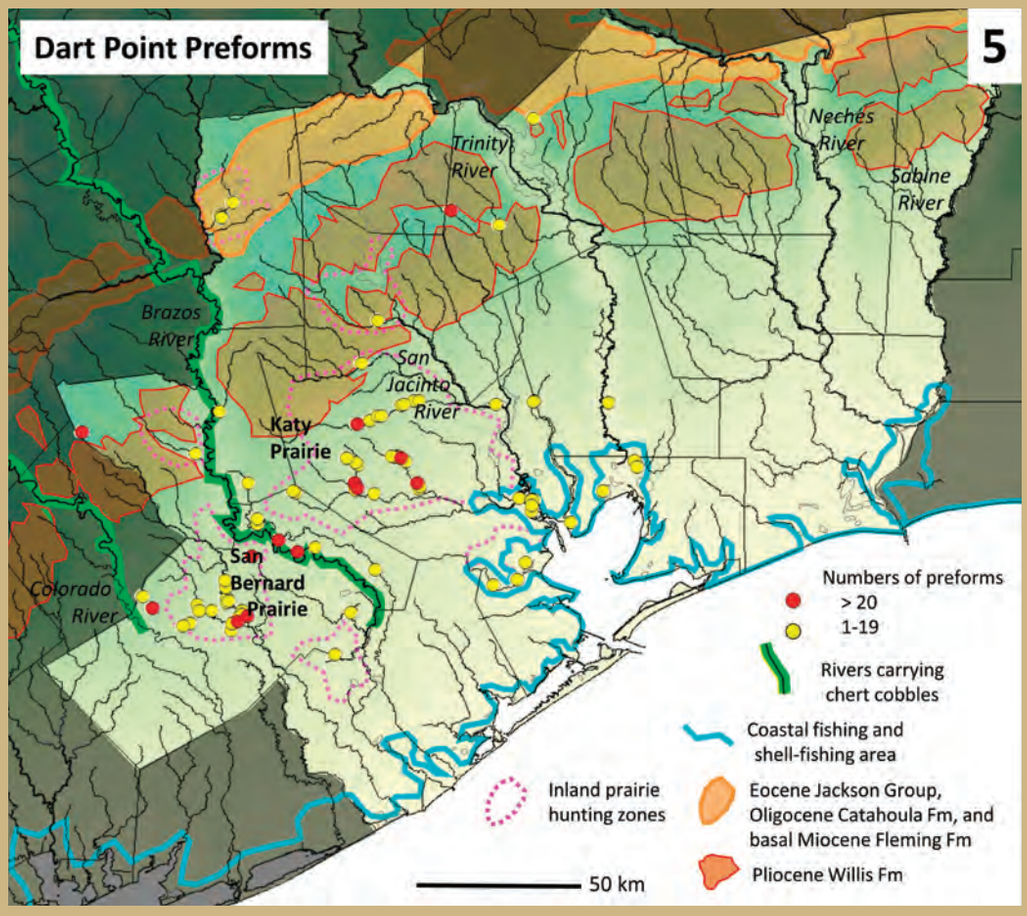
# Atlas III
# Lithic resources and tools

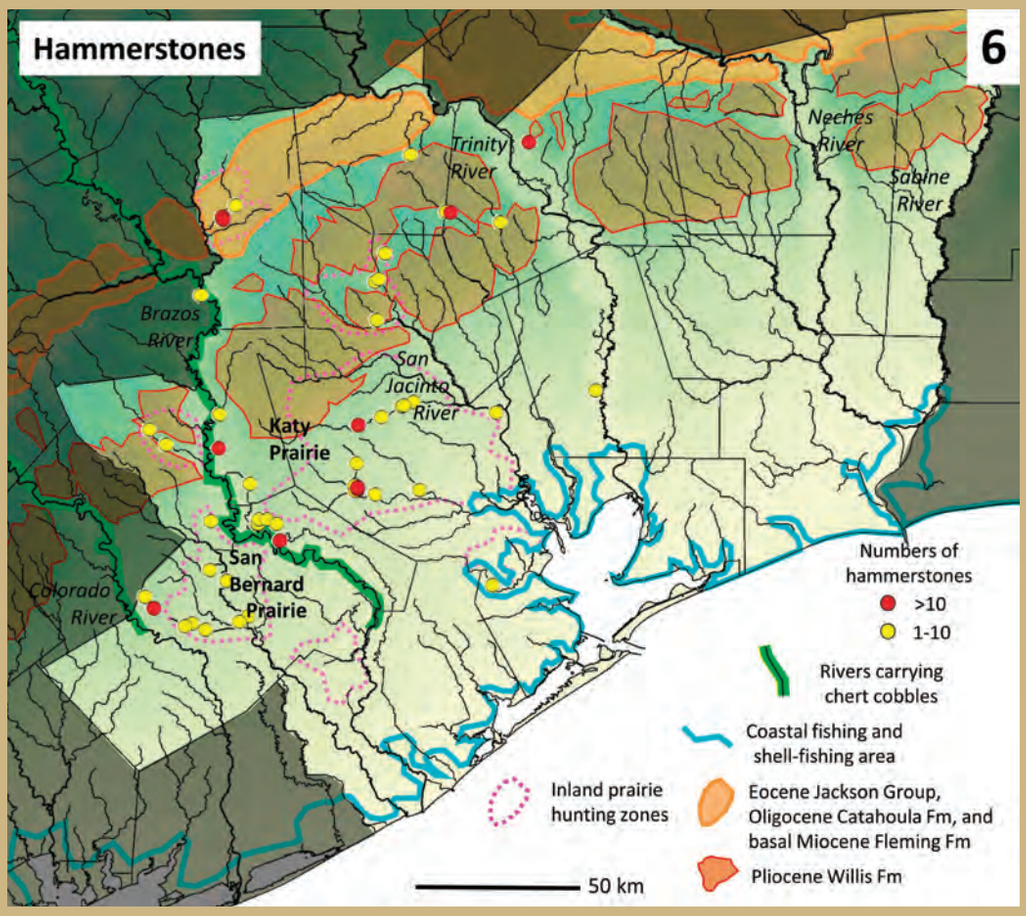


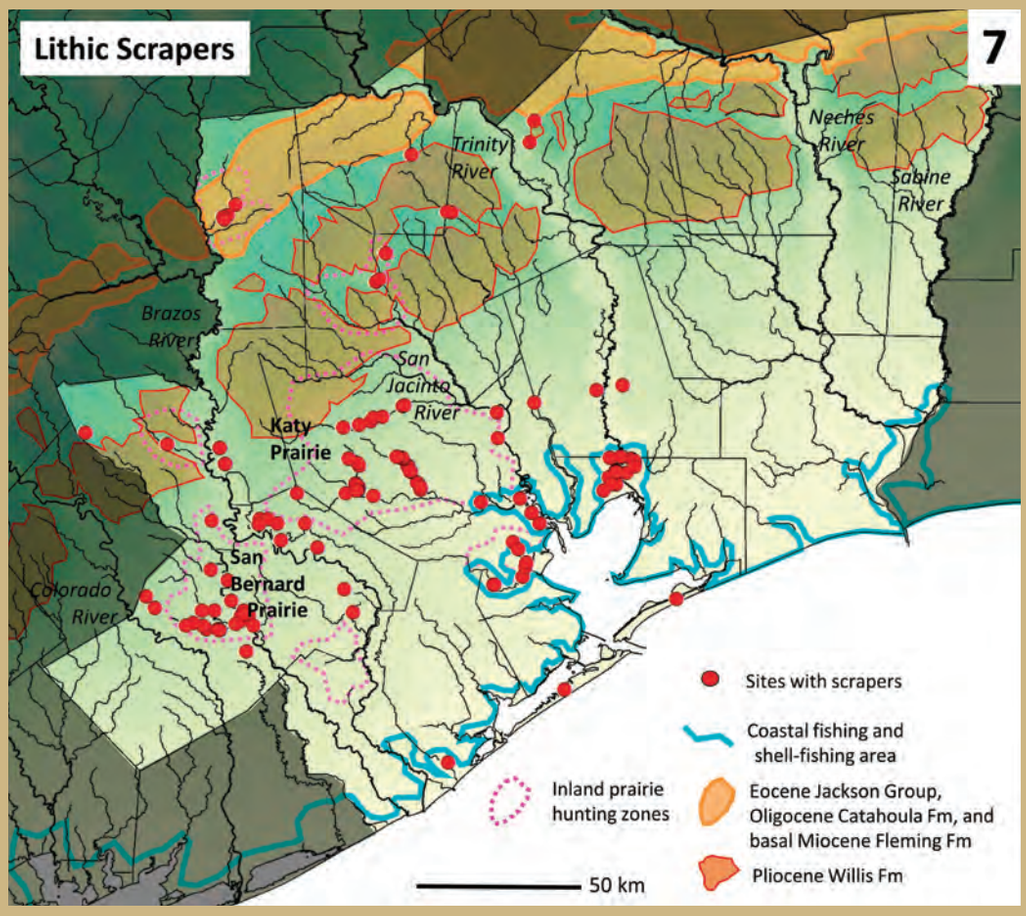

Chert Cobbles
2
Trinity River
Neches River
Sabine River
Brazos River
San Jacinto River
1
Katy Prairie
San Bernard Prairie
Colorado River
Sites with chert cobbles
Rivers carrying chert cobbles
Coastal fishing and shell-fishing area
Inland prairie hunting zones
Eocene Jackson Group, Oligocene Catahoula Fm, and basal Miocene Fleming Fm
Pliocene Willis Fm
50 km

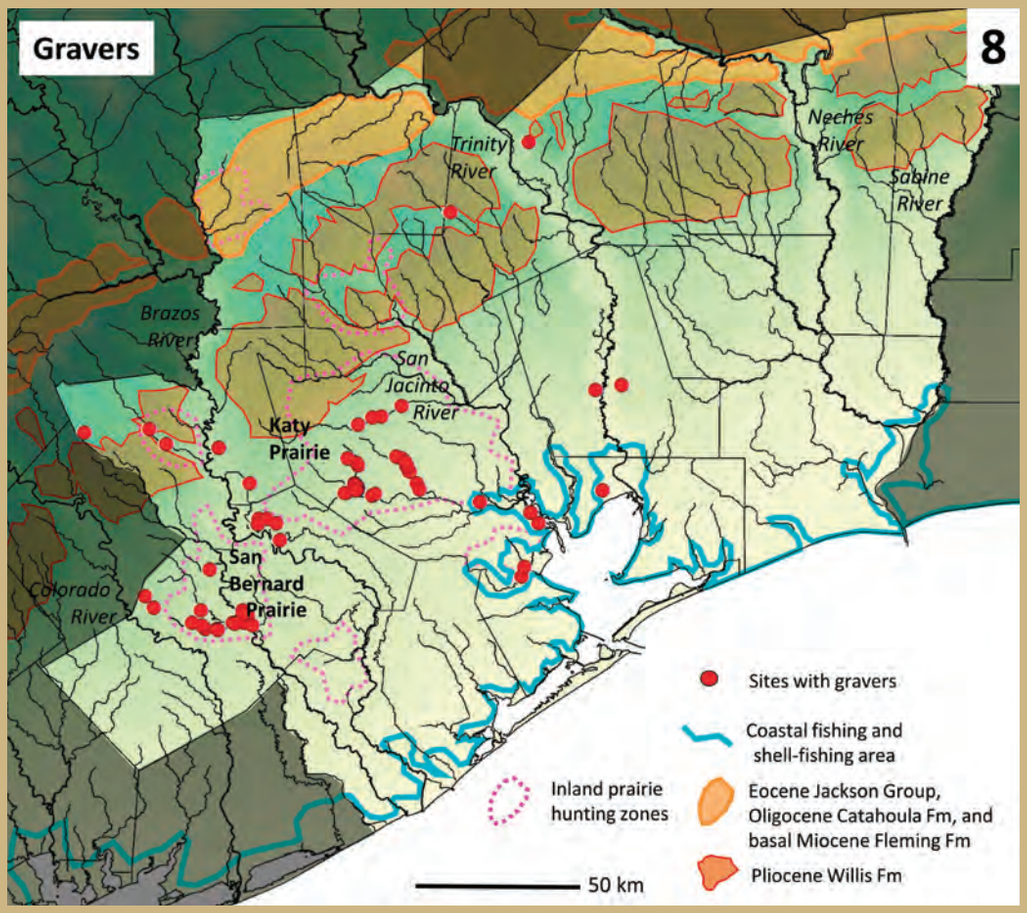

Chert Cores
3
Trinity River
Neches River
Sabine River
Brazos River
San Jacinto River
1
Katy Prairie
2
San Bernard Prairie
Colorado River
Numbers of cores
> 20
1-19
Rivers carrying chert cobbles
Coastal fishing and shell-fishing area
Inland prairie hunting zones
Eocene Jackson Group, Oligocene Catahoula Fm, and basal Miocene Fleming Fm
Pliocene Willis Fm
50 km

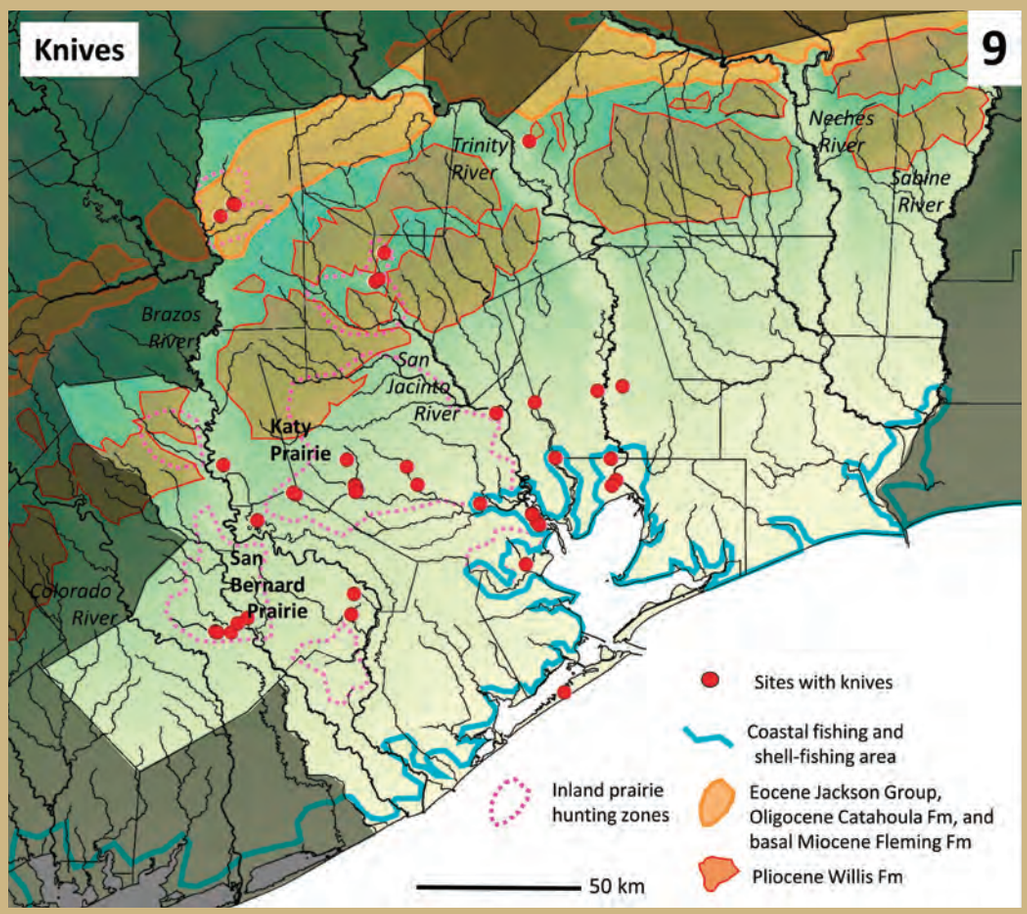

Large Lithic Flakes
4
Neches River
Trinity River
Sabine River
Brazos River
San Jacinto River
Katy Prairie
San Bernard Prairie
Colorado River
1
2
3
4
5
6
7
Large Lithic Flakes
(> 15mm in size)
> 500
1-499
coastal areas with any size flakes (not sized)
Coastal fishing and shell-fishing area
Inland prairie hunting zones
Eocene Jackson Group, Oligocene Catahoula Fm, and basal Miocene Fleming Fm
Rivers carrying chert cobbles
Pliocene Willis Fm
50 km

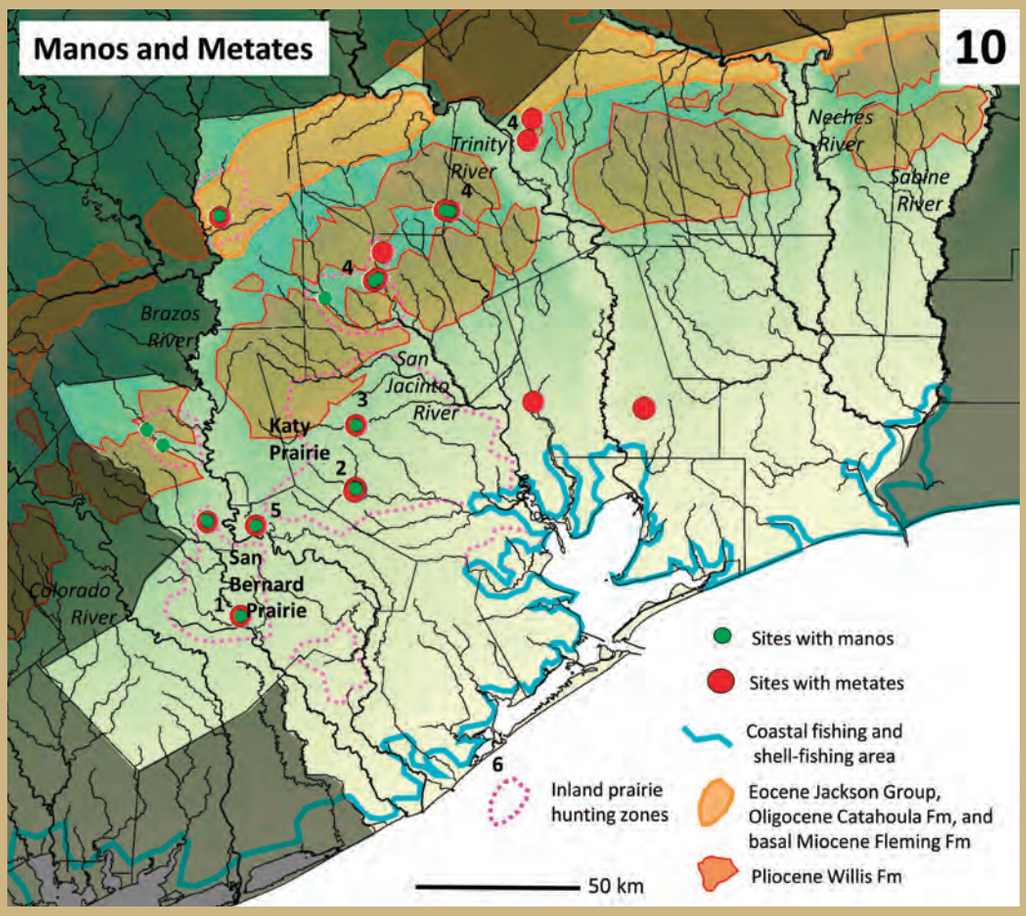

Dart Point Preforms
5
Neches River
Trinity River
Sabine River
Brazos River
San Jacinto River
Katy Prairie
San Bernard Prairie
Colorado River
Numbers of preforms
> 20
1-19
Rivers carrying chert cobbles
Coastal fishing and shell-fishing area
Inland prairie hunting zones
Eocene Jackson Group, Oligocene Catahoula Fm, and basal Miocene Fleming Fm
Pliocene Willis Fm
50 km

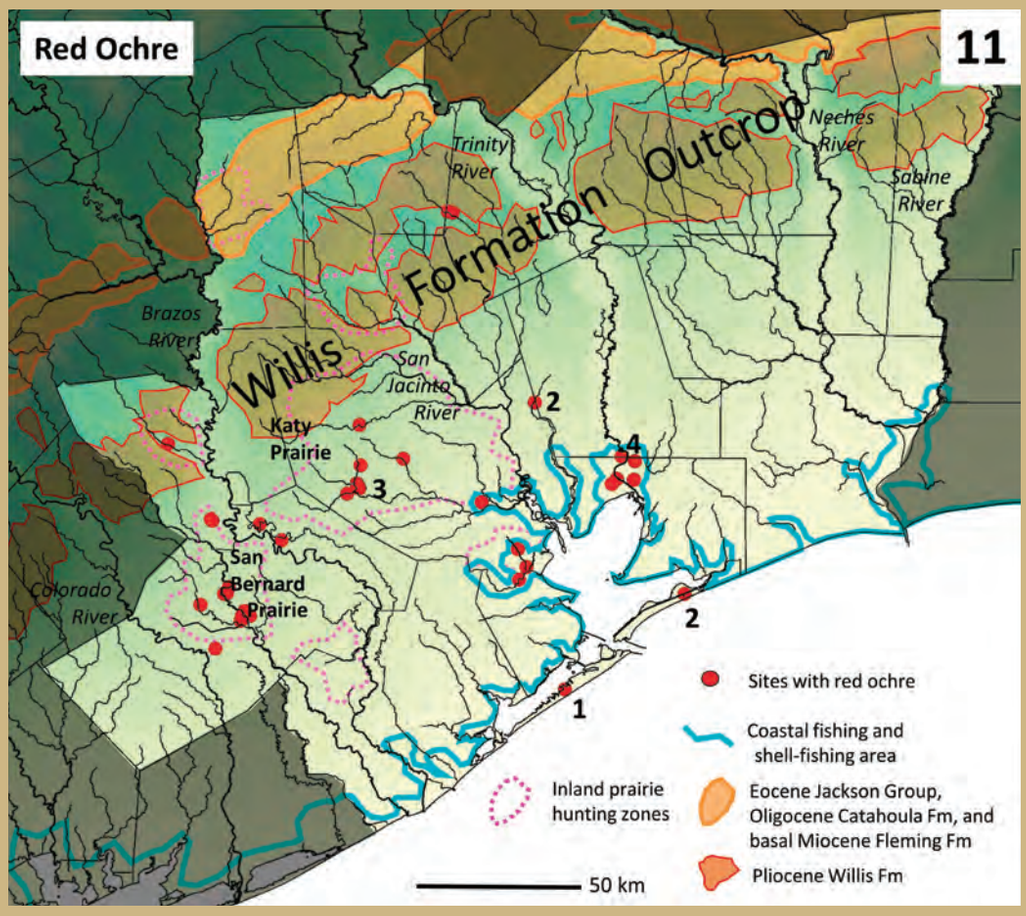

Hammerstones
6
Trinity River
Neches River
Sabine River
Brazos River
San Jacinto River
Katy Prairie
San Bernard Prairie
Colorado River
Numbers of hammerstones
>10
1-10
Rivers carrying chert cobbles
Coastal fishing and shell-fishing area
Inland prairie hunting zones
Eocene Jackson Group, Oligocene Catahoula Fm, and basal Miocene Fleming Fm
Pliocene Willis Fm
50 km

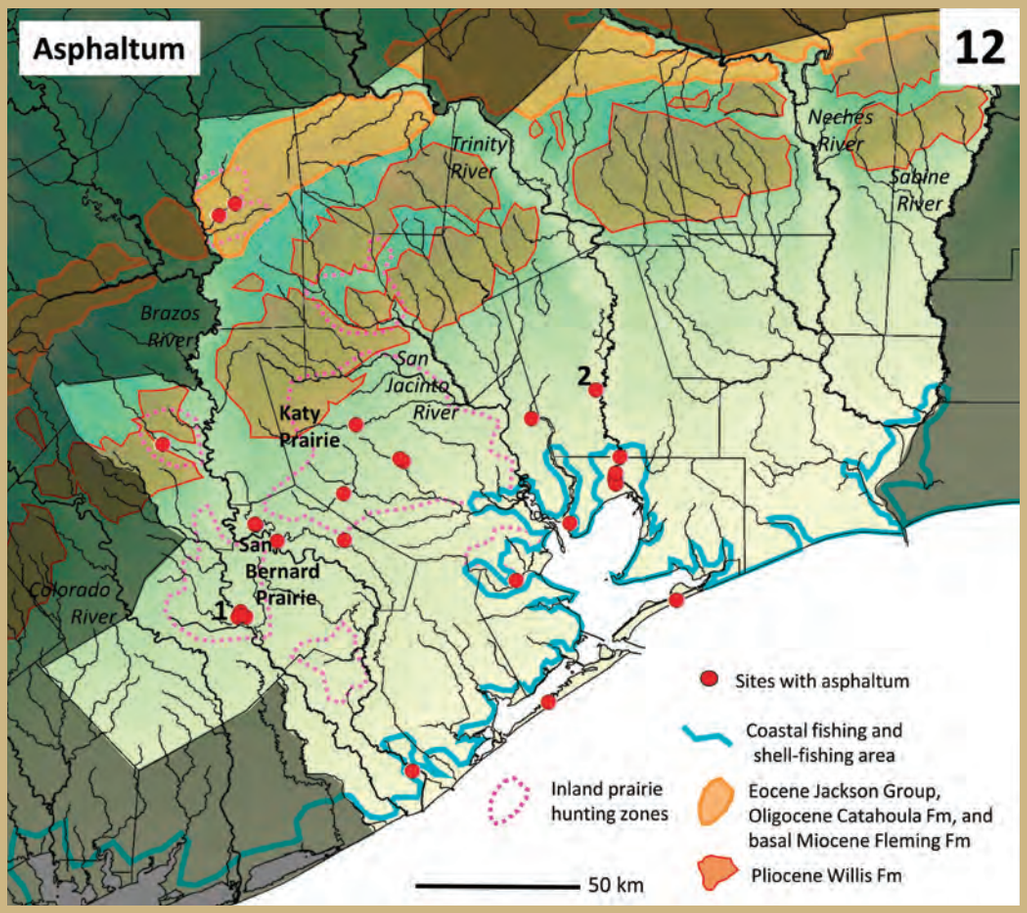

Lithic Scrapers
7
Trinity River
Neches River
Sabine River
Brazos River
San Jacinto River
Katy Prairie
San Bernard Prairie
Colorado River
Sites with scrapers
Coastal fishing and shell-fishing area
Inland prairie hunting zones
Eocene Jackson Group, Oligocene Catahoula Fm, and basal Miocene Fleming Fm
Pliocene Willis Fm
50 km

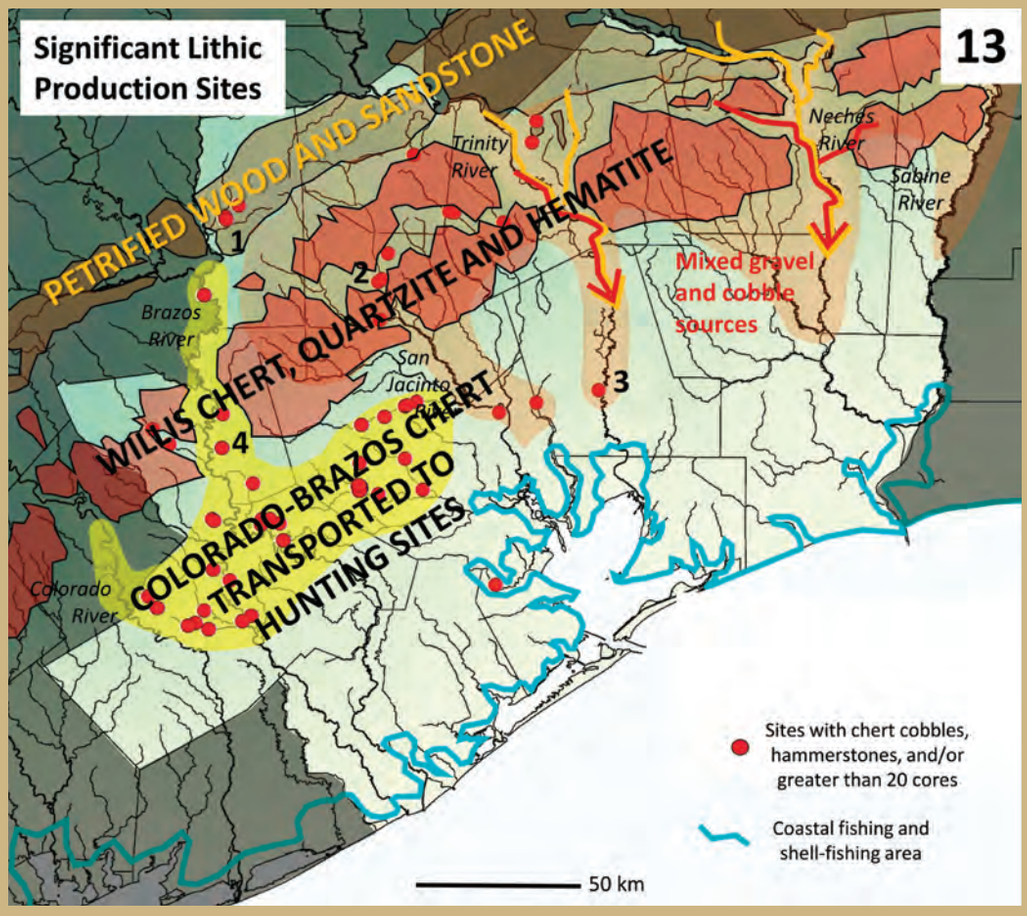

Gravers
8
Trinity River
Neches River
Sabine River
Brazos River
San Jacinto River
Katy Prairie
San Bernard Prairie
Colorado River
Sites with gravers
Coastal fishing and shell-fishing area
Inland prairie hunting zones
Eocene Jackson Group, Oligocene Catahoula Fm, and basal Miocene Fleming Fm
Pliocene Willis Fm
50 km


Knives
9
Trinity River
Neches River
Sabine River
Brazos River
San Jacinto River
Katy Prairie
San Bernard Prairie
Colorado River
Sites with knives
Coastal fishing and shell-fishing area
Inland prairie hunting zones
Eocene Jackson Group, Oligocene Catahoula Fm, and basal Miocene Fleming Fm
Pliocene Willis Fm
50 km


Manos and Metates
10
Trinity River
Neches River
Sabine River
Brazos River
San Jacinto River
Katy Prairie
San Bernard Prairie
Colorado River
Sites with manos
Sites with metates
Coastal fishing and shell-fishing area
Inland prairie hunting zones
Eocene Jackson Group, Oligocene Catahoula Fm, and basal Miocene Fleming Fm
Pliocene Willis Fm
50 km

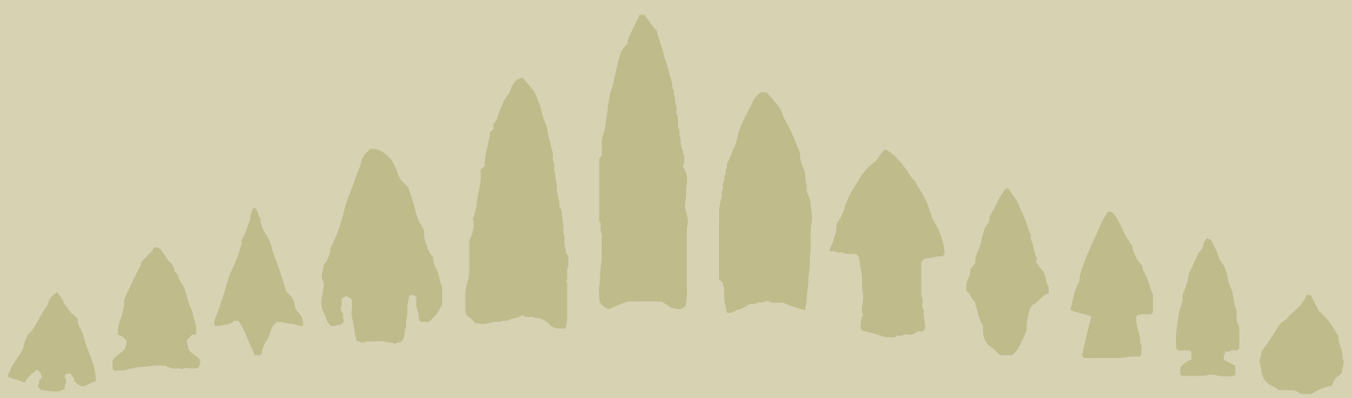

Red Ochre
11
Willis Formation Outcrop
Trinity River
Neches River
Sabine River
Brazos River
San Jacinto River
Katy Prairie
San Bernard Prairie
Colorado River
Sites with red ochre
Coastal fishing and shell-fishing area
Inland prairie hunting zones
Eocene Jackson Group, Oligocene Catahoula Fm, and basal Miocene Fleming Fm
Pliocene Willis Fm
50 km


Asphaltum
12
Trinity River
Neches River
Sabine River
Brazos River
San Jacinto River
Katy Prairie
San Bernard Prairie
Colorado River
1
2
Sites with asphaltum
Coastal fishing and shell-fishing area
Inland prairie hunting zones
Eocene Jackson Group, Oligocene Catahoula Fm, and basal Miocene Fleming Fm
Pliocene Willis Fm
50 km


Significant Lithic Production Sites
13
PETRIFIED WOOD AND SANDSTONE
WILLIS CHERT, QUARTZITE AND HEMATITE
COLORADO-BRAZOS CHERT TRANSPORTED TO HUNTING SITES
Mixed gravel and cobble sources
Trinity River
Neches River
Sabine River
Brazos River
San Jacinto
Colorado River
1
2
3
4
Sites with chert cobbles, hammerstones, and/or greater than 20 cores
Coastal fishing and shell-fishing area
50 km

A campsite on the Trinity River.
Woodcut by Barbara Whitehead.

# Part III
# Putting It All Together



# 10.

# The paleogeography of Southeast Texas peoples

In previous chapters, the development of the physical landscape of Southeast Texas since the Last Glacial Maximum has been reviewed, its former vegetal cover reconstructed from historical and paleontological data, the idea of discrete and long duration lifeway zones for humans on that landscape has been considered, distributions of projectile points have been inspected for geographic information on their makers and users, and ethnohistorical information has been gleaned for pointers to earlier prehistoric behavior. In this chapter, all of this information is brought to bear on a summary helicopter-level interpretation of the physical and cultural prehistory of this region, time slice by time slice. The twelve paleogeographic maps presented in Chapter 2 are used as a base for the compilation. The lithic chronology used is summarized in Figure 10.1, which shows (in purple shading) the intended temporal duration of each time slice (B through M; see Chapters 5 and 7 for discussion of the chronology).

The physical and human landscape of this area has been profoundly shaped by rising sea level throughout the time of known occupancy by humans. Using Gulf of Mexico sea level data of Balsillie and Donoghue (2004), the relative rate of sea level rise during the twelve chosen time intervals can be displayed (Figure 10.2). Sea level rise was most rapid between about 14,500 BP (map level 3, Upper Paleolithic) and 7,000 BP (map level 9, end Early Archaic). Although there have not been any definitive artifacts associated with humans yet found on the modern submerged

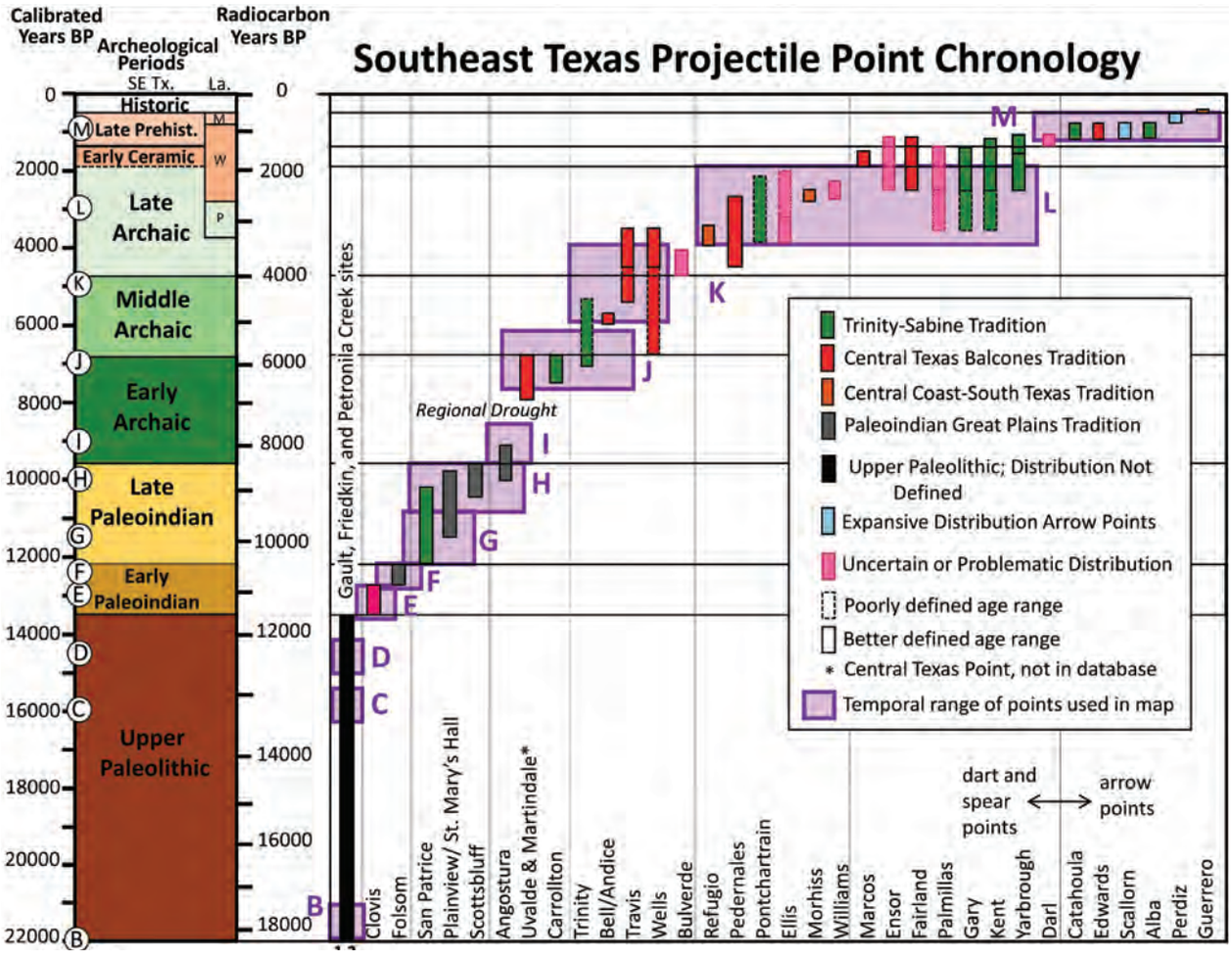



Figure 10.1. Lithic chronology for Southeast Texas, highlighting time intervals of paleogeographic maps B–M (Atlas IV). Purple boxes depict both the temporal range of each map, given the approximate nature of projectile point time estimates, and the projectile points included in each paleogeographic map of Atlas IV. Sources of projectile point temporal data are listed in Figure 7.3. Assign-ment of points to various traditions and groups (see legend) is discussed in Chapter 7.

Texas shelf (which was fully exposed at the time of the Last Glacial Maximum 22,000 years ago), occupation patterns gleaned from onshore lifeway zones defined in Chapters 6 and 8 allow a tentative projection of lifeway zones into now-submerged areas where hunters and fishermen in past eras would have lived.

Information on human occupancy is scant to nonexistent for the first three time slices, and increases with each subsequent interval. By the beginning of the Late Archaic, the coastline of Southeast Texas was grossly similar to that of today, and sea level exerts a much more limited effect on the landscape. At this time, other effects cause rapid change in what has seemingly been a slow-to-change Late Paleoindian through Middle Archaic human landscape. From the Late Archaic Period onward, the effects of imported technology, especially involving ceramic and bow and arrow use, plus the escalation of regional exchange systems are best viewed from a larger, continent-wide view, which is presented in Chapter 11.

## Upper Paleolithic Period

### Background: Human entry into North America

At the time of the Last Glacial Maximum (LGM), about 22,000 years ago, most of Canada and a large part of southern Alaska were beneath the large Laurentide and Cordilleran ice sheets (Figure 10.3). Continuous ice sheets extended as far south as the northern parts of North Dakota, Minnesota, and Wisconsin. Because of

the enormous amount of water contained in the thick sheets, global sea level had fallen as much as 125 m at the time of the Last Glacial Maximum (Figure 10.2). As a result, most of the now submerged Bering Shelf that connects Eastern Siberia and Alaska was exposed. Until fairly recently, many archeologists had believed, in lieu of firm evidence to the contrary, that humans using Clovis lithic tools were the first to enter North America at around 13,000 BP (e.g., Martin 1967, 2005), just as an ice-free passage began to develop between the Cordilleran and Laurentide ice sheets. Figure 10.3 shows the hypothesized interior passageway. Using dated materials, Dyke (2004) suggested that it was not fully open until about 12,500 BP or even 12,000 BP., later than the hypothesized Clovis entry along that route. More recently, Pedersen and others (2016) found that steppe vegetation in the corridor was not established until about 12,600 BP, suggesting that Clovis-age people could not have used the route.

Evidence that has emerged in the past two decades has caused archeologists to discard the "Clovis first" theory, however, and to postulate a much earlier entry by humans into North America. The earliest evidence of humans in central Alaska, at Sand Point, suggests that people had arrived there by 14,500 BP (about 11,900 rcyBP), a thousand years before Clovis (Holmes 2011). Adovasio and Pedler (2019) compiled evidence from a number of recent studies of significant pre-Clovis sites in the Lower 48 (Figure 10.3), including:

1) The Meadowcroft rock shelter in Pennsylvania, contains charcoal from fire pits dated from 12,800 to 16,175 rcyBP, or about 15,500 to almost 20,000

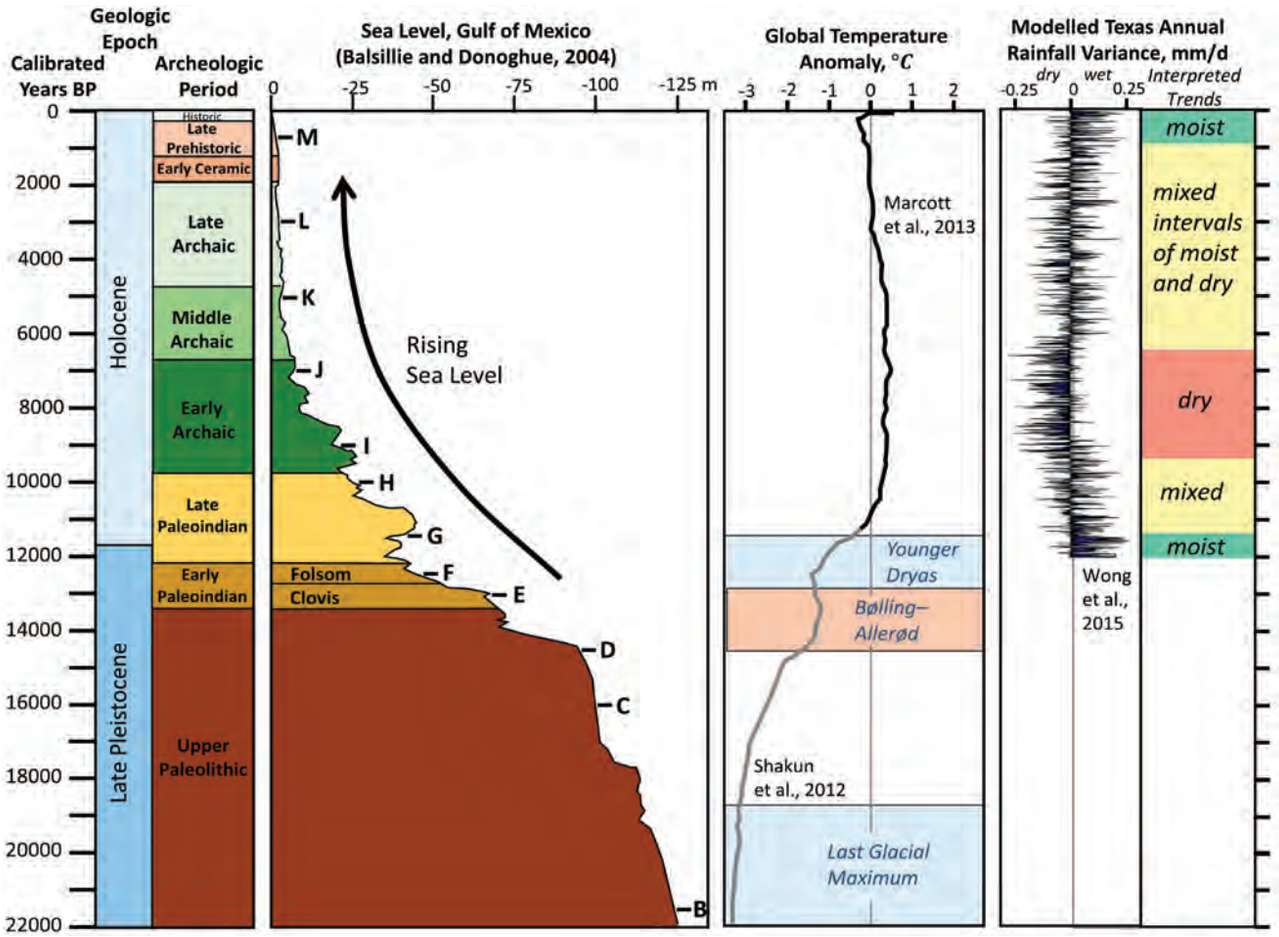



Figure 10.2. Left: Sea level rise vs. time, as plotted against an archeolog-ical chronologic chart. Letters B–M refer to paleogeographic map levels in Atlas IV. Sea level data are taken from Balsillie and Donoghue (2004). Right: Global temperature anomaly (from Marcott et al. 2013; Shakun et al. 2012); Late Pleistocene temperatures have been shifted 0.25 degrees. Data for modelled annual rainfall variance for Texas is from Wong and others (2015), shown with permission of Elsevier.

cal BP.

2) Cactus Hill, Virginia, contains hearths and related charcoal concentrations with related lithic tools that yield radiocarbon dates of 15,070 to 16,940 rcyBP.

3) Miles Point, Maryland, a paleosol containing a number of lithic tools, is dated at 18,000 to 25,000 cal BP.

4) The Chesrow complex in Wisconsin has lithic tool concentrations and mammoth remains, with dates ranging from 10,960 to 13,530 rcyBP.

5) The Paisley Caves in southern Oregon contain bone and associated lithic debitage dated from 11,625 to 12,400 rcyBP.

6) The Page-Ladson site near the Florida Gulf Coast is a mammoth kill site with an anthropogenically modified tusk dated at 12,425 rcyBP.

Jumping to South America, at the Pacific Coast site of Monte Verde, Chile, reliable dates push back the time of human occupancy to at least 18,000 BP (Dillehay et al. 2015) and possibly earlier. On the Atlantic coast, the site of Arroyo Seco 2 in Argentina shows that the time of occupation of the Pampa began by at least 14,000 BP (Politis et al. 2014; Suárez 2019).

Closest to Southeast Texas are the Gault-Friedkin site in Bell County and the Petronila Creek site in Nueces County (Figure 10.3).The Gault and Friedkin sites (in reality, one extensive site separated by a property boundary) lie along an upstream tributary of the Brazos River, where an extensive Clovis assemblage is underlain by an older, equally extensive Upper Paleolithic sequence named the Gault assemblage (Williams et al. 2018; Waters et al. 2018). These pre-Clovis materials yield OSL dates of at least 16,000 BP to as much as 20,000 BP and include lithic bifaces, blade-and-core pieces, and parts of small lanceolate projectile points (Figure 10.4). All of these items are technologically distinct from later Clovis lithic traditions. It would seem that distinct and advanced Clovis blade technology arrived at this site rather than evolved at this site, although core-and-blade technologies are similar (Williams et al. 2019).

Figure 10.3. Map showing the extent of the North American ice sheet at ca. 15,000 BP and the principal known North American Upper Paleolithic sites. Ice area generalized from Dyer (2009). Site locations after Adovasio and Pedler (2018) and Lewis (2009). Southeast Texas project area outlined in red.

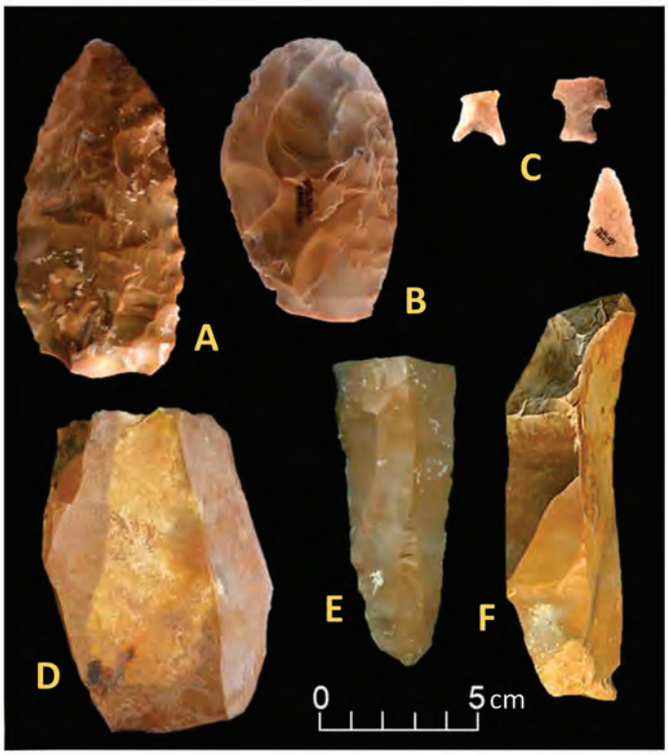



Figure 10.4. Gault assemblage lithic (Edwards chert) artifacts. A, B = bifaces; C = small projectile points; D = blade core; E, F = blades. Courtesy of Tom Williams, Gault School of Archeological Research, Austin.

At Petronila Creek, in Nueces County south of Corpus Christi, as mentioned in Chapter 3, a Late Pleistocene bone bed exposed along the creek of that name has yielded a trove of bones in a midden (Lewis 2009). Bones of mammoths, ground sloths, bison, deer, camel, small mammals, and various species of fish, reptiles, and land snails were recovered. Human evidence included modification of bones for tool use, some small chert tools, two broken pieces of projectile points, and abundant charcoal and blackened clay nodules. Radiometric dating of a mammoth femur yielded a date of 18,000 rcyBP, or about 21,632 BP. That date would place humans not far from Southeast Texas at about the time of the Last Glacial Maximum (Figure 10.3).

These early human occupancy dates from the Americas (and Texas) precede the development of both Clovis material culture and the hypothesized ice-free corridor. Given that the Cordilleran "ice-free corridor" in northwestern Canada was not available even to Clovis-era people, and moreover that the earliest arrivals came at least as far back as the time of the Last Glacial Maximum, when the polar ice cap was at its farthest south extent, how did the "first-in" early people get here? DNA evidence points to an Asian origin for all Native Americans, and archeological data in the Russian Far East suggest that humans could have migrated into "Beringia" at about 34,000 to 31,000 BP, before the Last Glacial Maximum (Graf 2014; Graf and Buvit 2017). A currently favored hypothesis is that these early immigrants came south from Beringia along the Pacific coast, island-hopping with simple watercraft as they fished and hunted in marine littoral areas (Fladmark 1979), along what later came to be known the "kelp highway" of marine resources of edible shellfish, fish, marine mammals, and birds, extending over vast stretches of coast (Erlandson et al. 2007; Madsen 2015). Presumably humans then entered the interior, probably along rivers. Initial dispersal along this route would be relatively rapid.

The archeological site-specific data supporting such a route are difficult to find, primarily because the 125 m rise of sea level since the LGM has nearly everywhere submerged evidence of such coastal people. One of the oldest coastal sites showing use of estuarine shellfish is at Santa Rosa Island, California, where a shell midden contains remnants of estuarine mussels and other shellfish, as well as bones of geese and ducks, remains that are at least as old as 12,000 to 11,350 BP (Erlandson et al. 2019). Similar marine cultures were documented at Cedros Island, Baja California (12,000 BP; Des Lauriers 2010); Huaca Prieta, Peru (15,000 BP; Dillehay et al. 2017); and Monte Verde II, Chile (14,000 BP; Dillehay et al. 2008).

The bathymetry of the Pacific Coast is relatively steep, so that occupation sites along the present coast are typically not geographically far from coastal sites at the

LGM, now submerged to 125 m depth. The situation on the Gulf Coast is drastically different. A very gently sloping Texas continental shelf means that the current coastline at Galveston Island is fully 180 km (130 miles) from the Late Pleistocene shoreline (Frame B, Atlas IV). Evidence of estuarine fisheries of early man is thus underwater on a broad continental shelf. There are some tantalizing bits of evidence but nothing definitive:

1) The Petronila Creek site (Lewis 2009) places humans on the Late Pleistocene coastal plain at the time of the LGM, only 130 km (80 miles) from the coast.

2) Mammoth, mastodon, and ground sloth teeth and bones of Late Pleistocene age have been recovered from the offshore South Texas shelf at Seven and One-Half Fathom reef, in what appears to have been an old lake bed, now in 14 m (46 feet) of water (Tunnell and Causey 1969; Thayer et al. 1974; Darnell 2015), demonstrating that the now submerged shelf would have presented attractive hunting targets for humans at the time of the Petronila Creek occupation.

3) A core taken a few miles offshore of the coast at the mouth of the Sabine River yielded what appears to be an organic-rich midden including charred wood, nut hulls, fish scales, and a high density of bone fragments, dated at 8,800 rcyBP (about 10,000 BP, Late Paleoindian Period; Pearson et al. 1989).

Of course, such scant data hardly prove that pre-Clovis humans and their Paleoindian successors utilized the rich marine and estuarine resources of the paleo-Texas coast, but given the fact that their coeval cousins along the Pacific Coast lived on such marine resources, it would seem very likely. Fish, shellfish, seabirds and the like represent a resource much richer and more temporally stable throughout the year than are the resources the interior plains and forest, with a possible exception being certain riverine areas.

## Last Glacial Maximum, 22,000 BP (Frame B, Atlas IV)

The landscape of coastal and interior Southeast Texas at the time of the Last Glacial Maximum (ca. 22,000 BP) is shown in Atlas IV, Frame B. The time depicted on this map is before even the oldest of the Gault assembly ages, and older than most of the dates from the other North American pre-Clovis sites mentioned. At this time all of Southeast Texas and southwestern Louisiana drained into one large Brazos-San Jacinto-Trinity-Neches-Sabine-Calcasieu-Mermentau river system, which debouched into the Gulf of Mexico at a single point. The coastline was over 250 km farther out than it is today and was fairly stable in position. Global temperatures were about 3 degrees Centigrade cooler than today, according to Shakun and others (2012; see Figure 10.2). Climate models of Cordova and Johnson (2019), using pollen and phytolith (silicified plant microfossils) data from Hall's Cave in Central Texas as well as other climate proxy data from the surrounding region, suggest that precipitation near the time of the LGM was considerably higher than that of the present day.

The only Texas site of this period currently known is the aforementioned

Petronila Creek site near Corpus Christi Bay (Frame B). The mix of grass-eating herbivores, browsers, and carnivores seen at Petronila Creek (mammoths, ground sloths, bison, deer, camel, small mammals, and various species of fish, reptiles, and land snails; Lewis 2009), as well as a similar mix of Late Pleistocene fauna in the Southeast Texas area (Chapter 3), indicate that the environment offered both grasslands and forest. If the interpreted human tools found at Petronila Creek are approximately the same age as the dated mammoth femur (about 21,632 BP), then humans were present on the landscape depicted in Frame B. The Petronila Creek site lies about 80 miles inland of the paleo-coastline, so it is very likely that humans would have found the coast and its resources. Coastal occupation, if it existed, would likely have occurred where rivers reached the coast, providing the possibility of limited brackish water fish and shellfish resources (the blue-shaded areas of Frame B). There were probably no significant bays at this time.

### 16,000 and 14,500 BP, Upper Paleolithic (Frames C and D, Atlas IV)

As the climate began to warm slowly following the LGM, the rate of sea level rise was relatively slow at first (Figure 10.2), and the coastline depicted on maps for 16,000 and 14,500 BP has retreated but little past its maximum advance at the LGM (Frames C and D).

By this time, early Native Americans had arrived in the area, as evidenced by the pre-Clovis Gault assemblage mentioned above, located in Bell County at the upper left of these maps. Lithic evidence of their presence there at this time includes chert blades and blade cores, biface tools, and small projectile points of both stemmed and lanceolate forms (Figure 10.4), found stratigraphically beneath later Clovis items. The lithic items are technologically and morphologically distinct from later Clovis forms, suggesting some separation in time and probably culture; the Upper Paleolithic items are dated to no younger than 16,000 BP, after which there is a temporal hiatus before the deposition of the Clovis-bearing sequence (Williams et al. 2018). There are no known cultural deposits at the Gault site of the age of the map in Frame D (14,500 BP), but at the nearby Friedkin site, Waters and others (2018) describe stemmed projectile points ranging from ca. 13,500 to 15,500 BP.

People were also in northwest Florida at the Page-Ladson site (Halligan et al. 2016) during this time period, suggesting that much of the Gulf Coast region may have been populated—but there are no lithic materials yet found and dated in Southeast Texas or Louisiana to confirm this. Outlines of the three major lifeway zones—coastal fishing and shellfishing, large river hunting and fishing, and inland prairie and hunting zones, shaded blue, yellow and pink, respectively—have been added to the maps as potential residence sites; again, no evidence for that residence has yet been found in Southeast Texas. If occupation patterns follow that of Clovis and later populations, these lifeway zones represent where people who used the Gault assemblage toolkit might have been living.

Several arguments suggest that people were not confined to the area of the Gault and Friedkin sites. First, the Gault site lies at the foot of the Balcones Escarpment, adjacent to Cretaceous limestone outcrops to the west that contain some of the highest quality chert in North America (Williams et al. 2019; Banks 1990). To

the east lay the Gulf Coast Plain, a lush landscape of prairie and riparian forest that would have been brimming with game. The obvious thing for Gault-era hunters would be to fashion their tools at the chert outcrop and then head east to hunt, returning when they needed more lithic supplies. The updip tributary of the Brazos River, where the Gault site lay, would make an obvious highway toward the Texas prairies and savannah, and a bit farther on to the lush grasslands near the coast. Only 200 km of travel downdip would place them in the Katy or San Bernard prairies, depending upon which side of the Brazos they travelled along. This Upper Paleolithic hunting route is, of course, unfounded conjecture at this point. It seems likely that future work will unearth Upper Paleolithic sites in the Southeast Texas area, especially with the advent of OSL technology, which has not yet been systematically applied in the Southeast Texas region. This technology was a critical part of calibrating the pre-Clovis dates at Gault (Williams et al. 2018).

Food resources in the coastal zone may not have been well developed at this time. No large bays had yet developed, as was discussed in Chapter 2, and thus there probably were no large areas of rich brackish water fauna (Map frames C and D). At the mouth of the Brazos, sedimentary output rate was high, and sedimentation rate was equally high; mud-laden turbidites were pouring into the upper slope until 15,300 BP as a result of a climate that was considerably cooler and wetter than today (Pirmez et al. 2012). That muddy water debouching rapidly into the Gulf, with no quiet bays, would bode poorly for a large marine and bay fishery. No marine materials (shell ornaments or tools) have been found at Gault and Friedkin (or at Page-Ladson), suggesting that either they were dissolved in the soil or they were never obtained from the coast. In short, there is little evidence at this time for the presence of a large brackish water food resource, but neither is that presence precluded. However, a rich array of Late Pleistocene megafauna was present, as discussed in the preceding section and in Chapter 3.

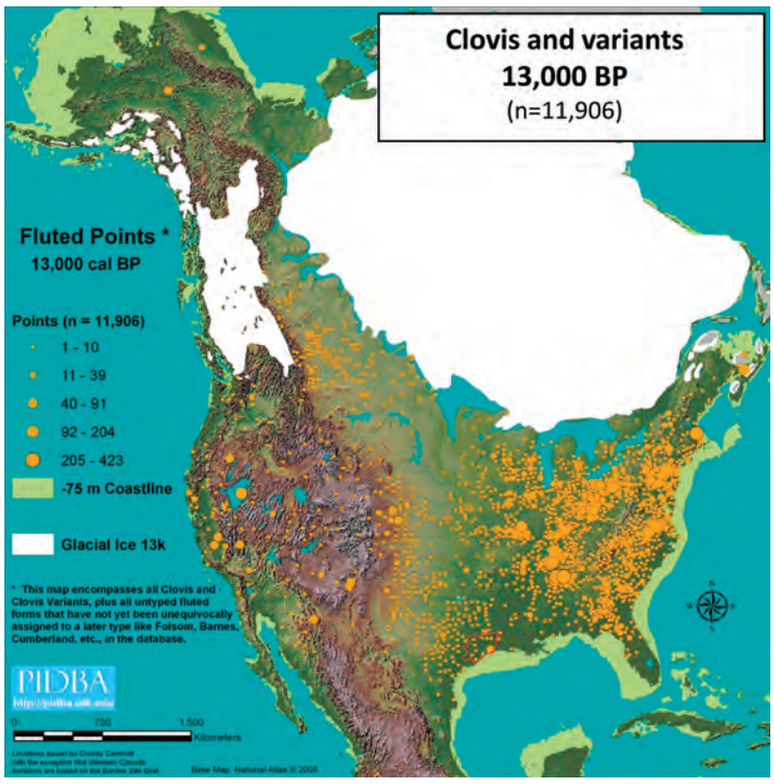



Figure 10.5. Two time slices from the Paleoindian Database of the Americas (www.pidba.utk.edu; Anderson et al. 2009). Southeast Texas project area boundary superimposed in red. Left, Clovis and Clovis variants, with ice limits at ca. 13,000 BP. Right, Folsom and coeval Redwood/Cumberland/Barnes and Suwannee/Simpson points, with ice limits at ca. 12,000 BP.

## Early Paleoindian Period

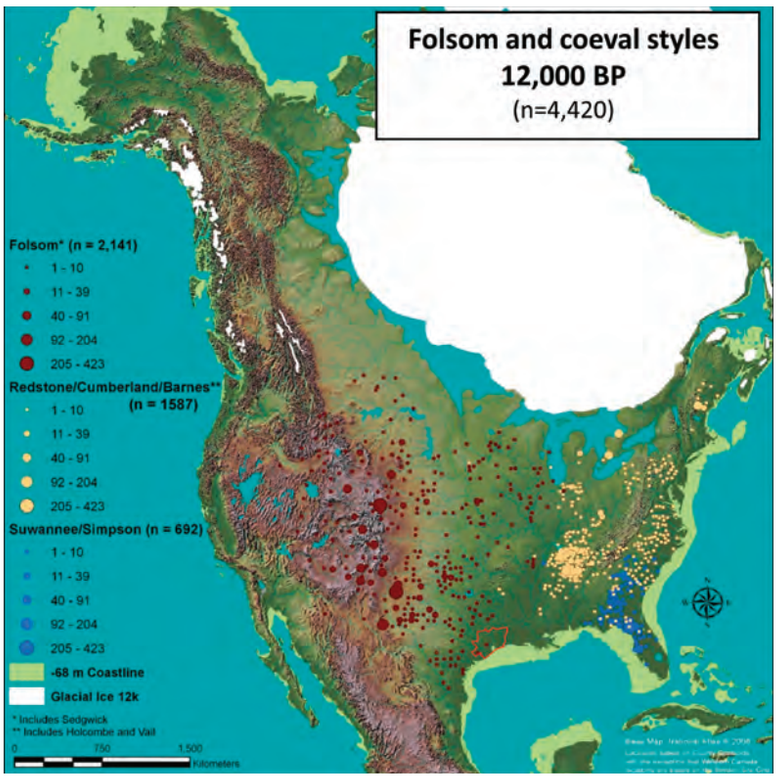
### 13,000 BP, beginning Early Paleoindian (Frame E, Atlas IV)

Clovis "people," or more properly, people using Clovis tools, comprise the earliest yet documented residents of Southeast Texas. The era of Clovis occupation is variously dated as between 13,500 to 12,700 BP (Williams et al. 2018; Waters et al. 2018); the paleogeographic map at 13,000 BP (Frame E, Atlas IV) is placed within most estimates for Clovis age. The position of the shoreline on that map shows that the retreat from the LGM shoreline position had begun in earnest as a result of more rapid global warming during the Bølling–

Allerød climatic period (14,690 to 12,890 BP), and sea level was rising rapidly (Figure 10.2).

By any measure, the appearance of Clovis tools in nearly all parts of ice-free North America in the Early Paleoindian Period is remarkable relative to the paucity of Upper Paleolithic sites (Figure 10.5). Some have ascribed that explosive growth in apparent population to waves of advance of people wielding new Clovis tools (the overkill, Clovis-first theory of Martin (1967 and 2005), now largely disproven) or to rapid population growth during early colonization, perhaps using "staging areas" or refugia where points could be made and new parties then sent out to colonize new areas (Anderson 1990). To support such growth, one might assume that the Clovis toolkit was new and allowed more efficient hunting. However, the basic shapes of lanceolate and stemmed points were available to early North Americans for millennia earlier, as shown at Gault (Williams et al. 2018; Figure 10.4). It may also be that the quickened pace of climatic warming during the Bølling-Allerød climatic period, which overlaps Clovis time (Figure 10.2), stimulated rapid growth in numbers of human hunters and their prey.

There are 14 sites with Clovis-era materials in the Southeast Texas project area (Frame E). Of these, six are found in areas linked with prairie hunting in later Holocene time, and eight are related to lifeway zones of large river floodplains (see following sections). The coastline, like that in map levels B–D, probably lacked any large bays, suggesting that coastal brackish water marine resources would have been limited to the mouths of rivers at the sea (blue areas, Frame E). Of course, there are no certain archeological sites of this age in what is now the continental shelf, including what would have been the coastal zone. There are also no indications in Clovis-era materials at any of the Southeast Texas archeological sites of any coastal influence (marine shell ornaments or beads, for example); thus whether there was a significant coastal occupation in Clovis time is unknown.




**Prairie hunting lifeway zone.** On the western tributaries of Buffalo Bayou (location 1, Frame E), a single Clovis point was found at the lowest level of an excavation at the Doering site of Wheat (1953) that included evidence of occupancy from Clovis time through the Late Prehistoric. It is one of a dense cluster of sites there (location 3, Figure 8.11) that exist at the end of a long, tree-lined cul-de-sac interpreted from the landscape setting as a bison kill site (Chapter 8), where bison were thought to have been killed and processed in a gullied tributary of the bayou (see Figures 8.11, 8.14, and discussion, Chapter 8). The single Clovis point in its described setting at Doering is not in itself unequivocal evidence of such hunting use

of the site at that time, but the periodic re-use of the particular site for millennia is suggestive.

At Cypress Creek two Clovis points have been found, at the Lockwood site (41HR343) and at 41HR731 (location 2, Frame E). The Lockwood site is a surface collection from a deflated soil midden. It has not only several Clovis points but also early and late Paleoindian points such as Folsom, Midland, Early Side-Notched, Dalton, San Patrice, Plainview, Angostura, and Early Stemmed. There is also an abundant group of Archaic through Late Prehistoric lithic materials. Another Clovis point was recovered on the creek at 41HR731, from another surface collection. As discussed in Chapter 8, Cypress Creek is lined with hunting sites of periodic occupation over a long period of time, with faunal evidence of bison and deer hunting and the use of fired clayball cookery. The two Clovis sites there, as well as at the Doering site along Buffalo Bayou, are the earliest evidence for the long occupation of these sites.

Two other sites suggest similar occupational histories but were not treated in detail in Chapter 8. The Dyersdale site, 41HR60, lies along Greens Bayou (location 3, Frame E), and 41HR64 lies along Hunting Bayou (location 4). The stratified Dyersdale site, destroyed by stream channeling in 1940, had been collected and partly excavated, and contained lithic evidence of a long occupation history extending from Early Paleoindian through Late Prehistoric time, including Clovis, Angostura, Wells, Bell, Bulverde, Williams, Refugio, Evans, Palmillas, Gary, Kent, Yarbrough, Pontchartrain, Catahoula, Clifton, and Perdiz points (Howard et al. 1991:77–78). Mammoth and mastodon bones were found along with many Holocene and younger species (especially deer). Fired clayballs, "numerous small heaps" of charcoal, bone fragments, and lithic debitage leave little doubt that this was a hunting camp on the far eastern fringe of the Katy Prairie; the creek was likely the kill site, just as at the Buffalo Bayou and Cypress Creek sites. Again, the evidence for Clovis presence is scant and related to only a few points. When combined with the more abundant evidence of later periods, as well as the long-term periodic re-use of the sites over millennia, the findings suggest that Clovis-era hunters were the first to recognize favorable hunting settings.

Site 41HR64, on the east side of Hunting Bayou, contained a Clovis point and a Scottsbluff point. Like the preceding sites, this location contained a very wide array of lithic points dating from Early Paleoindian through the Late Prehistoric, in nine "campsites" that included an Early Ceramic and younger *Rangia* shell midden (Ring 1994). The sites are clustered along a short stretch of a small, narrow wooded stream adjacent to coastal prairie. There were over 1,000 caliche nodules, a few fired clayballs used as heating stones, and a few hearths. A large amount of bone debris, much of it fractured to remove marrow, was found in a steep gully, suggesting a gullied kill site, but with maddeningly little detail from the 1959 excavation. Significantly, all nine sites contained abundant charcoal at several levels, suggesting to Ring that these were not campsite fires but rather evidence of recurrent ground fires throughout the millennia. This is the clearest evidence yet found in Southeast Texas for recurrent fire associated with hunting campsites. Again, Clovis hunters frequented a site that has resonated with hunters over a very long span of time.

Finally, a Clovis point was found on Orchard Dome in the San Bernard Prairie

(location 5, Frame E, and location 10, Figure 8.32). Two Clovis points, two Scottsbluff points, twelve Plainview and seventeen San Patrice points were found there in an array that spanned Early Paleoindian through Archaic time periods (Patterson 1997a, 1997b). The site is on the northwest side of the Orchard salt dome, which rises about 10 to 15 feet above the surrounding prairie: a perfect site for viewing game to the northwest in the San Bernard Prairie. Also in San Bernard Prairie, site 41WH19, 20 km south of Orchard Dome (discussed in Chapter 8), yielded a Folsom point in a well-stratified deposit. A proboscidean bone recovered in the lowest stratigraphic level, beneath the level where the Folsom point was found (Patterson et al. 1987), suggests that the site's earliest occupation may have been related to Late Pleistocene megafauna hunting, coeval with the Clovis points found at nearby Orchard Dome (Patterson 1997).

To summarize, the six sites at which Clovis points have been found are ones with long spans of periodic occupation, all located either along small forested streams (5 sites) or on an elevated nearby hill (1 site). The landscape setting and overall lithic assemblages of these sites, as discussed in Chapter 8, suggest that the sites are all related to hunting. Associated Late Pleistocene faunal data are scant but locally include mammoth, mastodon, and bison. The streams along these very long-lived sites have (or once had) steep gullies that in some cases contain bison bone debris. Dense clusters of these long-lived sites, as at the Doering site along Buffalo Bayou or the Cypress Creek and Hunting Bayou sites, suggest that the setting was conducive to repeated re-use over time by hunters who were acting communally. Confirming evidence would require a well-stratified, excavated Clovis site, which may someday emerge.

Most Clovis materials found at McFaddin Beach and along the Trinity River, discussed later, are made from Edwards chert (as are 75% of 123 Paleoindian artifacts found at the McFaddin site, according to Stright et al. 1999). It would seem likely that Clovis hunters at these prairie and river sites linked back to a refugium (an environmentally favorable "home base" for long-term residence) on the Balcones Escarpment, where they had abundant supplies of Edwards chert, and followed their quarry to the east and southeast along the prairies north of the Brazos River each year during the seasonal bison (and other large animal) migration (Chapter 7).

**Large river floodplains lifeway zone.** Six Clovis sites are located along floodplains of large rivers within or near the edge of the East Texas forest, representing a lifeway that is distinctly different from the sites of the prairie hunting zone (e.g., see Figure 6.1). These sites suggest that people who used Clovis tools were hardly the monolithic roaming big game hunters that they once were thought to be. Two sites are on the terraced riverbanks of the San Jacinto River, two on the Trinity, and one each on the Angelina and Neches. An additional two sites are beach finds, not in situ, that seem clearly related to now submerged offshore extensions of rivers that are now submerged.

The Timber Fawn site (location 6, Frame E) is located along a high terrace on the south side of the East Fork of the San Jacinto River. It consists of a surface collection of Clovis-era artifacts found in a suburban neighborhood, including two Clovis projectile point bases, a fluted quartzite biface, several long curved blades and blade fragments that have measured affinities to tools known from other Clovis

sites, and a collection of well-made end scrapers, gravers, and a small hammerstone. A squared-off bit end of an adze and one of the blades are shown in Figure 10.6, items H and I (Crook et al. 2016). Another item of particular interest is a quartzite gorget with a drilled hole at its center, and scratch marks in the form of x's (Figure 10.7, from Crook et al. 2016). Several of the artifacts appear to be made of Edwards chert from Central Texas, and the site had no observed debitage, indicating that the artifacts were made elsewhere by hunters with mobility. Crook and others interpret that site as a single occupation. The adze suggests woodworking; similar adzes of Archaic age in the Trinity River area have been suggested to have been used for log dugout boatbuilding (see discussion, Chapter 6).

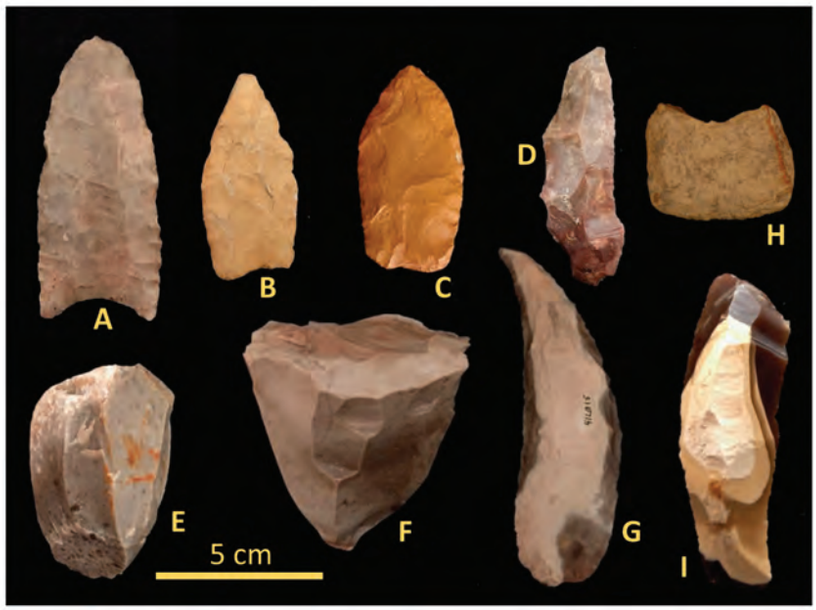
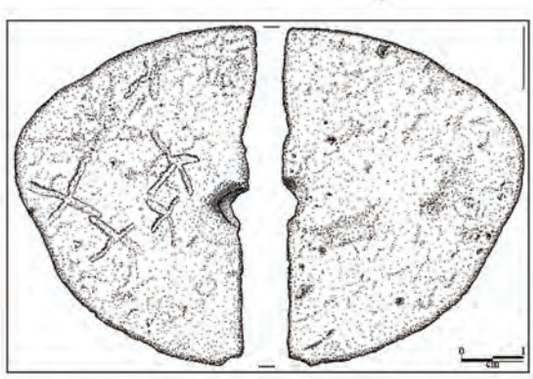



Figure 10.6. Clovis lithic materials from the Wood Springs site, 41LB015. A–C = well-worn projectile points; D, G = blades; E, F = chert blade cores (Crook 2017a, 2017b); H = bit end of an adze; I = blade, from the Timber Fawn site, Harris County (Crook et al. 2017). Photographs from the Andy Kyle Collection and Hous-ton Archeological Society, courtesy of Wilson W. Crook, III.

Site 41HR571 (location 7) was also once on a terrace above the San Jacinto River, but is now on the shore of Lake Conroe, and most of the site now appears to be underwater. A surface collection contains two Early Paleoindian Clovis points and a Scottsbluff, as well as Late Paleoindian Plainview, Golondrina (?), San Patrice, and Angostura points. Points of younger ages are also present, and in all, the site ranges in age from Early Paleoindian through Late Prehistoric (Patterson 1986). Paleoindian tools at the site include several Albany scrapers, a type of cutting tool usually associated with San Patrice points, as well as large lithic flake scrapers and gravers. As at Timber Fawn, the surface collection contains no faunal remains, so we are left with the site's geography to suggest a lifeway of hunting and fishing along the river and its floodplain.

There are two known Clovis sites on the Trinity River. The most substantial is the Wood Springs site in Liberty County (location 9, Frame E), reported by Crook (2017a). The site lies on a high Deweyville (Pleistocene) terrace on the east side of the river (Figure 6.13), which would have given advantages both in flood protection and in providing a perch from which to observe movements of game in the geologically younger and topographically lower floodplain below. Surface collections in the Andy Kyle Collection in Liberty, Texas, reported by Crook contain nine Clovis artifacts, including bases of two fluted points, two large blades, two overshot flakes, two small prismatic blades (items D and G, Figure 10.6), and a side-scraper or perforator made from a broken blade. Other Clovis artifacts from the Kyle Collection include three blades and several cores (items A–C and E–F). All of the nine Clovis artifacts from the Woods Springs site are thought to be of Edwards chert, indicating a Central Texas origin. The Clovis points are extremely



worn and show evidence of many re-sharpenings. Such is the case with another Trinity site (41PK36; location 8, Frame E); a single point found on the surface was heavily reworked (Table 44 in Story 1990).

A number of Clovis points have been found along the upper Neches and Angelina Rivers in Angelina and Polk counties (sites 10 and 11, Frame E). At site 41AG37 (location 11), a Clovis point of 10.3 cm with a blunt, reworked tip was found in 1948. It is one of four complete points found in a relatively restricted area on the outcrop of the Eocene Cadell Formation (Brown 1993). Each of the points is reworked and shorter than perhaps it was originally. One is made of Manning fused glass, a natural glass from nearby outcrops of the Manning Formation, where lignite beds burned adjacent to siliceous tuffs. The other three appear to have come from Edwards chert in central Texas. Slightly to the west, another heavily reworked point was found in Rockland (site 10). It is on a terrace above the Angelina River floodplain, along structural strike from the 41AG37 site, also near the Eocene outcrops (Table 44 in Story 1990). Nothing else is known about this point.

Until recent excavations at the Gault and Friedkin sites, the largest collection of Paleoindian and Archaic lithic material in Texas was at McFaddin Beach, a long stretch of beaches along the coast of Jefferson County and, to a lesser degree, Chambers County (location 14, Frame E). Fossils of extinct Pleistocene megafauna as well as Paleoindian and Archaic man-made lithic materials are regularly cast up along a 30 km stretch of coast after storms, and deposited on Quaternary beach sand, to be found by beachcombers. Russell (1975) described the Pleistocene megafauna, and Long (1977) and Turner and Tanner (1994) have described the archeological remains. The most recent major study has been that of Stright and others (1999), who studied some 800 projectile points in detail, tracking their provenance.

McFaddin Beach lies along the coast in between the Trinity and Sabine rivers. The points have been eroded from an offshore location and then thrown up on the beach during storms. Figure 10.8 shows the topography of the now buried and offshore Late Pleistocene erosional surface (from Simms et al., 2007), which was the exposed surface at the time of Clovis occupation. The Clovis and younger material appears to be eroding from what would be the northwestern terraced margin of the Sabine River. A nearby additional Clovis find at 41GV101 (location 13, Frame E, and Figure 10.7), a single point with dull edges from being tossed around in the surf (Huebner 1988) likely was eroded from the eastern terraced edge of the Trinity River, in a position similar to the Wood Springs site to the northeast. For these reasons, it seems appropriate to lump these beach finds with the same large river floodplain lifeway zone of the above six Clovis sites, although either or both could alternatively be prairie sites; the landscape data are not definitive.

Figure 10.7. Drawing of the engraved quartzite gorget from the Timber Fawn site, Harris County, Texas, from Crook and others (2016). The engraved "X's" on the obverse face to the left are highlighted. The gorget broke through the drill hole. Illustration by Lance K. Trask, courtesy of Wilson W. Crook.

Of 880 artifacts studied by Stright, 160 were classified as definitely or probably "Paleoindian," which for Stright included Clovis, Dalton, Plainview, and Hell Gap points. Clovis points constituted 21 of these artifacts. She analyzed the source regions of all datable artifacts, including 123 Paleoindian artifacts for which the source regions were identifiable. Of this group of 123 mostly chert artifacts, 92 (75%) were sourced from central Texas, with most of these (81) being from in situ Edwards chert. Another 8 of the 92 were interpreted to have been made from Edwards chert gravels, which could have come from the Colorado River. Another 12

(10%) came from sources in the Southern Great Plains and its rimming mountain ranges, such as the Ozarks, Ouachitas, and Arbuckles, as well as the Tecovas chert from the Triassic of Palo Duro canyon. Four (3%) came from sites in the northern Great Plains and its rim, including Nebraska. From East Texas and southwest Louisiana came a total of 14 (11%), of which 10 are fossil wood or fossil palm wood. From this, we can conclude that the great majority of people using Clovis technology obtained their chert in central Texas and were likely hunters emanating from that region. A secondary source of Edwards chert was from chert cobbles in the Colorado River, although that seems not too much closer to McFaddin Beach and was certainly not the source for the other more exotic lithic types mentioned above. The frequent re-sharpening of Clovis points found at McFaddin Beach (Figure 10.9) gives some support to the idea that Clovis points travelled a long distance to this spot and were somewhat necessarily re-sharpened and in some cases re-purposed over time.

From a regional map of Clovis sites (Atlas II, Frame 4) and the work of Collins (2007) it would seem likely that bison hunters had a refugium in the Edwards limestone outcrops where their tool factories were, and headed out from there on extended hunting trips into the Great Plains or, in this region, the Texas coastal plain. As discussed in Chapter 8, Central Texas hunters also appear to have been following seasonally migrating bison into the Katy and San Bernard prairies since Early Paleoindian time. The 10% of the Clovis population using tools from southern Great Plains materials and the 3% from northern Great Plains materials might have been using trade items, but perhaps more likely these items were brought by Central Texas people who had also hunted in the Great Plains. Finally, the 11% using tools made from East Texas and southwest Louisiana materials represent a

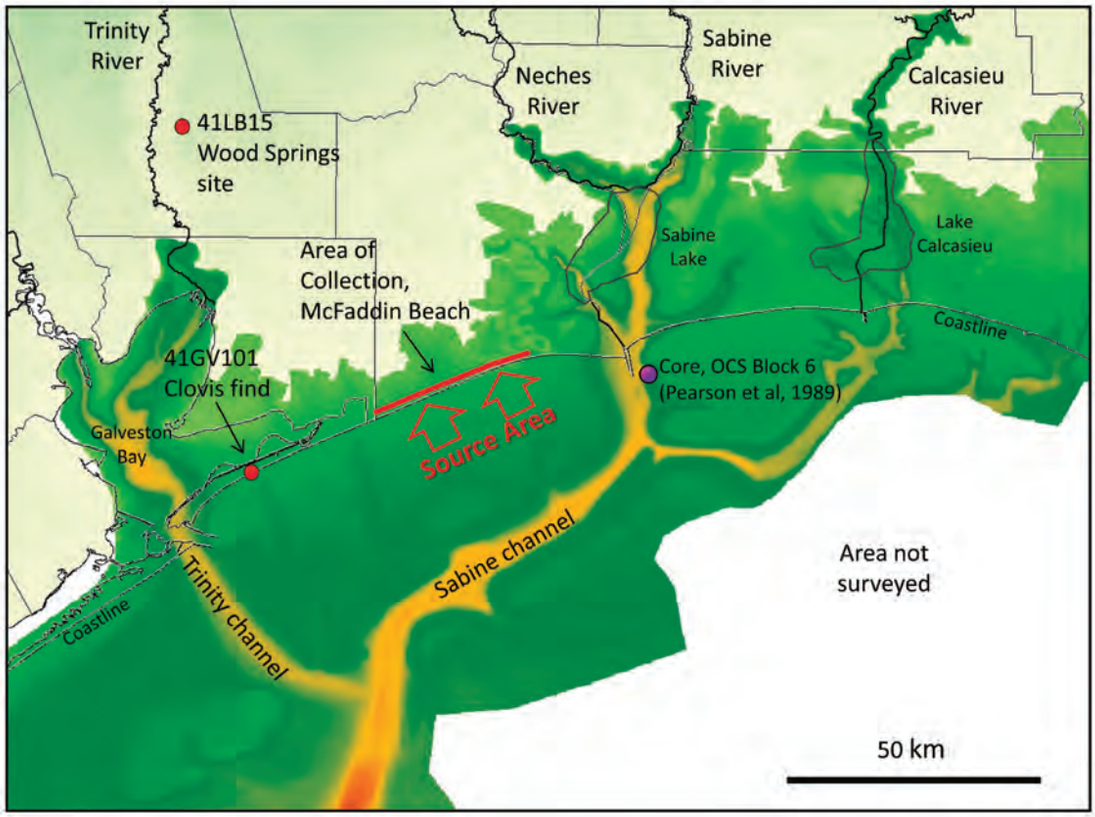



Figure 10.8. Offshore features of the McFaddin Beach area, Jefferson and adjacent counties. Shaded area consists of a structure map of the MIS2 unconformity/sequence boundary (see Chapter 2), showing Late Pleistocene topography and the locations of incised river valleys (from Simms et al. 2007). Large red arrows show inferred transport direction of lithic materials from eroding offshore source area to deposition areas along McFaddin Beach.

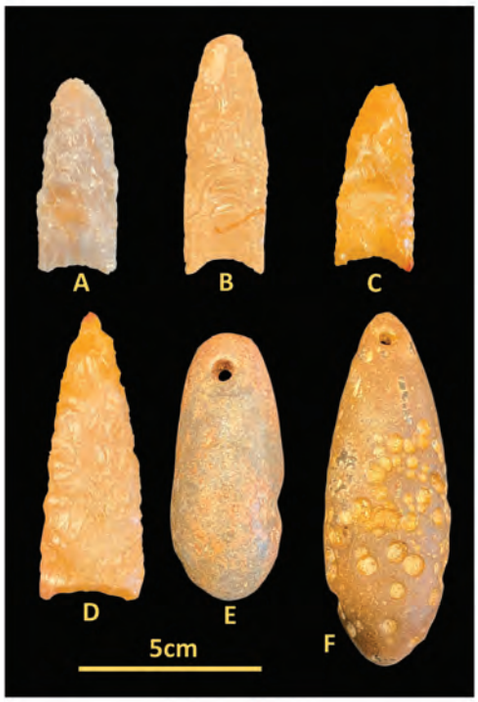



Figure 10.9. Six artifacts from McFaddin Beach (41JF50). A–C = re-sharpened Clovis points, Early Paleoindian Period; A and C are asymmetric and probably were repur-posed as knives late in their useful life. D = Plainview point, Late Paleoindian Period. All four points are chert. E–F = perforated ground stone plummets, probably Archaic, perhaps Late Archaic. From the collection of Larry Golden, Houston Archeological Society.

portion of Clovis-using people who perhaps had originated in central Texas (or whose ancestors had), but who then spent a good deal of time in Southeast Texas. This factor, plus the large amount of wear common on Clovis tools found in the river region and noted earlier, suggests that Clovis people were settling in eastern and southeastern Texas.

The most common faunal material found in McFaddin Beach collections is turtle shell, followed by bones and teeth of horses and deer. Mammoth and mastodon teeth are rare but present. Other fossilized bone specimens described by Russell include giant armadillo, camel, sabre-toothed cat, alligator, capybara, bear, tapir, beaver, and fish like gar and catfish: typical Late Pleistocene fauna (Russell 1975; Turner and Tanner 1994). Also present but not plentiful were bison. As shown on the map in Figure 8.1, plains-loving bison were not common in prehistory beyond the Katy and San Bernard prairies and adjacent Galveston Bay; the dense East Texas Forest provided a formidable barrier. So what brought plains hunters into the Pineywoods rivers to settle?

In the large river floodplains lifeway zone (Figure 6.1), the main source of foods beyond any Pleistocene megafauna included plentiful fish, turtles, alligators, and deer. If later populations can be a suggestive guide, fishing was probably accomplished with hooks and spear points made of bone. Alligators may have been caught with nooses and dragged ashore. Turtles were easy prey. Deer were small enough that a bone spear or atlatl point might deliver good results, especially if the deer were driven into a river to be killed. In this quiet environment of relatively small East Texas forested rivers and their adjacent floodplain valleys of swampy abandoned river channels and oxbow lakes, there was a lessened need for long, lance-like points; certainly that was the case after megafaunal extinction occurred by about the end of Clovis time. By fabricating lithic tools made from fossil wood and East Texas gravels, these settlers acclimated to their new environment. Their most-used projectiles, however, very likely were tipped with bone—mostly invisible in the archeological record of the East Texas forest—for the fish, alligators, deer and small mammals that increasingly became their primary diet. These abundant riverine food resources may have convinced the original migrants in Clovis (or earlier?) time to stay, even while other central Texas hunters returned to central Texas, living their plains life of (at least partially) following big game herds. The seeds of a division between the Paleoindian Great Plains (and later Central Texas Balcones) and Trinity-Sabine traditions of material culture may have been sown during the Clovis era.

### 12,500 BP, end Early Paleoindian (Frame F, Atlas IV)

At the end of Clovis time, a change in climate was accompanied by a change in the human presence on the landscape, both in Southeast Texas and in North America as a whole. Following the increased warming of the Bølling–Allerød period, the climate abruptly cooled during the Younger Dryas period, starting at about 12,900

BP (Figure 10.2). Several other events, probably at least partly related, occurred at about the same time. First, the extinction of most Pleistocene megafauna occurred by about 12,600 BP (Halligan et al. 2016). Although hunting pressure by people using Clovis tools is an often-cited potential reason, the change in vegetation over much of North American as it briefly returned to a more glacial climate during the Younger Dryas cooling event is another, and many paleobiologists support a mixture of the two causes (Broughton and Weitzel 2018).

However it occurred, the abrupt extinction of megafauna soon left the Great Plains with just three remaining large herbivores: bison, antelope, and deer. Second, it appears that there was a coeval population decline, as remaining hunters re-tooled in cooler weather to hunt bison on the Great Plains. These hunters adopted smaller, fully fluted Folsom points (Figure 10.10B) to manage changed circumstances, and their population decline can be theorized using numbers of Clovis vs. Folsom archeological sites and projectile points found in the Great Basin area, as well as with numbers of radiometric dates connected with Clovis and Folsom points, both of which methods are used as approximate proxies for population (D. G. Anderson et al. 2011). A comparison of maps of Clovis vs. Folsom points in the Paleoindian Database of the Americas (Figure 10.5, from D. G. Anderson et al. 2009) visibly shows the decline in points and in numbers of sites.

Effects of this apparent population decline are also notable at the smaller scale of Southeast Texas (Frame F). Whereas there are 14 known Clovis sites in the Southeast Texas area, there are only 5 known occurrences of Folsom points. Folsom points are slightly younger than Clovis and are considered to range in age from 12,200 to 12,700 BP (Waters and Stafford 2014). Unlike Clovis sites, which were found in both plains (prairie) hunting and East Texas forest/riverine settings, Folsom sites are found in grassland locations frequented by large herbivores—primarily bison, which are found at nearly all southern Great Plains sites in which Folsom points are preserved (Collins 2007). All of the inland Folsom sites are from prairie areas. Two are on Cypress Creek in the Katy Prairie (location 1, Frame F), at the Lockwood site (41HR343) and at 41HR 624 (Patterson et al. 1992a, 1992b). Both of the Cypress sites are part of a larger cluster of Cypress Creek sites that appears to have been associated with bison and deer hunting (Chapter 8). The Lockwood site had already been used in Clovis time.

Seaward from the Katy Prairie site is a coastal prairie site at 41GV53 (Location 2), where a Folsom point was found associated with an Early Paleoindian through Late Prehistoric site. The older points, which included Early Side-notched and San Patrice points, are from surface collections and indicate a prairie setting near a forested Clear Creek, possibly a stream kill site, although no bone remains were recovered from the Paleoindian portion of the collection. By the Middle Archaic, this hunting site was converted to a brackish water shell midden as sea level rise brought growing Galveston Bay close to the site (Patterson et al. 2001).

A Folsom point is the earliest clearly identified point type at the 41WH19 site in the San Bernard Prairie (Location 3). As mentioned in Chapter 8, this site is part of a long-occupied bison kill site, where campsites ring an enclosed impoundment (Area b on Figure 8.44A). At this site large numbers of fired clayballs were in use as early as Folsom time to cook, an activity thought to be connected with processing

large game meat (Chapter 8). Finally, two Folsom points were recorded at the McFaddin Beach site (Stright et al. 1999; Turner and Tanner 1994). The lithic source is not known but is likely to have been Edwards chert. Remains of extinct bison species have been recovered from McFaddin (Russell 1975).

The regional setting for Folsom points in the eastern half of Texas is shown in Atlas II, Frame 5. They are found almost exclusively in the broad plains and prairies in between central Texas and the East Texas forest, as well as along the Balcones Escarpment, where lithic workshops were occupied at sites like the Gault and Friedkin sites (Williams et al. 2018). The plains Folsom sites on this map relate to the hunting of bison (Collins 2007). The only Folsom sites that intrude into the East Texas forest are at its northwesternmost periphery, where salients of prairie intruded into the forest edge.

The paleogeographic map of Frame F shows that the shoreline had receded only slightly in a 500-year increment of time since Clovis time (Frame E); the rate of sea level rise had slowed because of Younger Dryas cooling (Figure 10.2). Perhaps the most important change in the 12,500 BP paleogeographic map relative to that of the previous 13,000 BP level is the apparent development of a long marine incursion in the flooded incised channel of the Sabine-Trinity channel, allowing the development of a brackish water bay that would eventually have been useful for fishing and shell-fishing. The arrival of a large brackish water zone would allow a new dimension to the riverine fishing and hunting zones that had originally enticed Clovis hunters from central Texas to settle a few hundred years earlier. With the demise of Pleistocene megafauna at the end of Clovis time, such a rich bay resource on the Southeast Texas coast would have been very welcome, and may indeed have been a factor that propelled a slightly later, apparent sharp increase in population in the large river floodplain lifeway zone, as indicated by increased numbers of Late Paleoindian sites. The Sabine-Trinity River would have had an estuary and small delta as it entered the long bay (location 6, Frame F), which may have been as sizeable as the modern Trinity delta, the home of dozens of Atakapa shell middens (see Figure 6.3 and discussion, Chapter 6). The modern offshore zone is all but completely unexplored in terms of archeological sites, as previously mentioned.

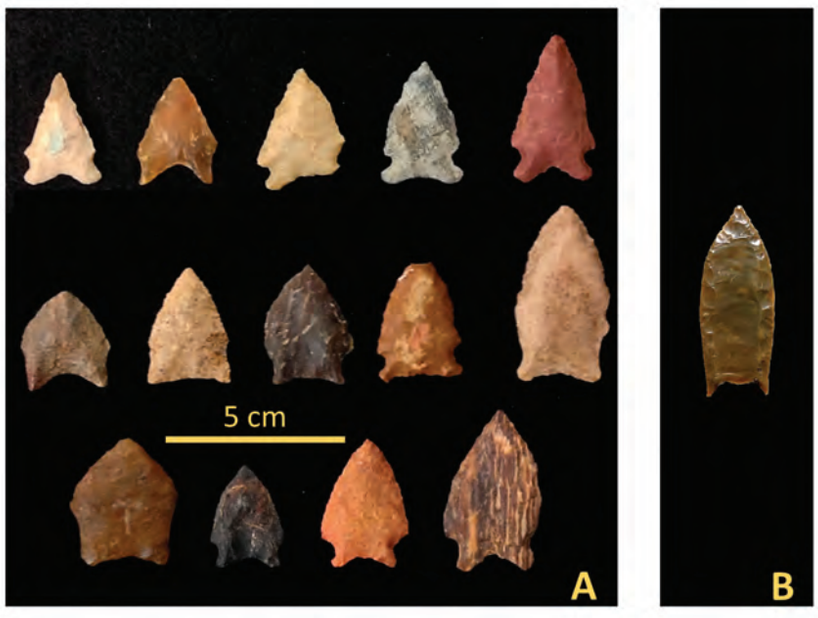



Figure 10.10. A. San Patrice points from Liberty County. Photographs from the Andy Kyle Collection, cour-tesy of Wilson W. Crook, III (Crook et al. 2017). Note the fossilized palm wood point, lower right corner, and the fire-treated point, upper right. B. A chert Folsom point from Cypress Creek, Harris County, from a display at the Houston Museum of Natural Science. Same scale as A.

During the same time period, the Brazos and Colorado rivers carried considerably more sediment than the smaller East Texas rivers, and as a result parts of their earlier-formed incised channels were filled, and deltas formed at their mouths (see Chapter 2). Thus it is likely that no bays had developed there, and brackish water resources would have been somewhat more restricted.

## Late Paleoindian Period

### 11,500 BP, beginning Late Paleoindian (Frame G, Atlas IV,)

At the beginning of the Late Paleoindian Period, sea level rise was relatively slow because of the continued Younger Dryas cooling event (Figure 10.2), but because the coastal topography was so flat, coastal retreat was still fairly rapid (compare Frame G with earlier Frame F). By this time, the flooding of the Trinity-Sabine river valley continued another 50 km inland, which effectively split the San Jacinto-Trinity River drainage basin from that of the Sabine-Calcasieu-Mermentau. In terms of potential sites for human occupancy on brackish water bays, this means that the former small bayhead delta on the Sabine-Trinity River (location 1, Frame G) was now split into two such small bayhead deltas, as the Trinity tributary split from the Sabine (locations 1 and 2, Frame G). Meanwhile, at the location of the outbuilding deltas of the more sediment-filled Brazos and Colorado rivers, there was still no equivalent bay (Location 3). There would be brackish water fishing at the mouths of these two rivers, just as one can catch crabs in the lower Brazos River delta today, but a well-developed coastal fishery—similar to that of modern Galveston Bay or Matagorda Bay—is not likely to have occurred there.

In inland areas—and all observed data of this time period are from inland areas—prairie sites now show usage by two different cultural groups. The Paleoindian Great Plains tradition is represented in the Katy and San Bernard prairies by the Plainview point, which is found throughout the Great Plains from southern Canada down to the South and Southeast Texas coast (see Atlas II, Frames 3 and 6). Points of this tradition and type that were found at McFaddin Beach were predominantly made of Edwards chert (Stright et al. 1999), suggesting that the Balcones Escarpment continued into the Late Paleoindian Period as a refugium, an ecologically favorable "home base" residence where points were also made.

Regional points distribution supports that idea. A sharp cluster of points along the Edwards Limestone outcrops (Atlas II, Frame 6; locations from Bousman et al. 2004) outlines their refugium and its tool workshops at the Edwards chert outcrops along the Balcones Escarpment, whereas Plainview locations are spread out across the plains to the northeast and southeast of the escarpment, demarcating their prime bison hunting area. The Plainview point is generally associated with plains bison hunting (Gunnerson 1987; Johnson 1989). As indicated in Frame G, Plainview hunters did not typically penetrate the East Texas forest, because their prey—chiefly bison—did not venture there. The distribution of Plainview points on the prairies but not in the forested zone is independent evidence that these visitors from the Balcones were in the Katy and San Bernard prairies to hunt bison.

The Katy and San Bernard prairies were also hunted by members of the early Trinity-Sabine Tradition, using San Patrice points. As can be seen in Frame G, although Plainview points are found only in prairie areas of Southeast Texas, San Patrice points are found in both the prairie settings and along the San Jacinto, Trinity, and Neches Rivers within the East Texas forest. These riverine areas within the forest together constituted a refugium for San Patrice culture—their riverine homeland (see discussion, Chapter 7).

**Plainview and the Paleoindian Great Plains Tradition.** Plainview points are

found at well-stratified site 41WH19 in the San Bernard Prairie, associated with an interpreted bison jump there (location 4; Patterson et al. 1987 and Chapter 8), and at the Owens site on Cypress Creek (41HR315; Patterson 1980; location 5), western Buffalo Bayou (location 6) and White Oak Bayou (location 7)—all inferred bison hunting sites.

Bison bones were found at McFaddin Beach (location 8, Frame G), as were both Plainview and San Patrice points (Russell 1975, and Stright et al. 1999). McFaddin Beach (or rather, the now submerged offshore source area for its points; see Figure 10.8) during Late Paleoindian time lay in the coastal prairie, accessible to bison entering the coast from the Katy and San Bernard prairies. As discussed in Chapter 8, and evident on the map of bison bone occurrences in Figure 8.1, bison reached the coast through those two prairies. Available archeological evidence (Frame G) suggests that they did not penetrate the East Texas forest to any great extent.

**San Patrice and the Trinity-Sabine Tradition.** Those same Katy and San Bernard prairie hunting sites were also used by people of the Trinity-Sabine Tradition, using San Patrice points (Frame G). If numbers of sites are any indication, there were many more San Patrice-wielding people than Folsom or Clovis users in the Southeast Texas area. Regionally, San Patrice is the first point style that reaches into Southeast Texas to have a more regional, as opposed to Great Plains-wide, distribution (Atlas II, Frame 3). They are found along the Trinity-San Jacinto and Sabine-Neches as well as the Red river valleys, mostly within the East Texas and Louisiana forest but extending also, sporadically, into the surrounding prairies (Atlas II, Frames 20 and 21). The distribution pattern shown in Atlas IV, Frame G for Southeast Texas is consistent with that pattern at a smaller scale. The interpretation discussed in Chapters 7 and 8 is that the large rivers within the East Texas and Louisiana forest constituted a refugium, with periodic bison and deer hunting in the surrounding prairies as game conditions permitted.

San Patrice points are shorter and stubbier than their Clovis predecessors, probably indicating the difficulty of finding adequate high quality lithic material in large sizes in much of the East Texas forest area (Chapter 9). With no Edwards material easily available, materials such as local Tertiary river gravels, as well as silicified wood and silicified palm wood, were substituted. The gravels were smaller than the cobbles in the Colorado and Brazos rivers out in the prairie areas to the southwest, and thus necessitated smaller points. Figure 10.10 shows examples from the Andy Kyle Collection from Liberty County, some of it from the Wood Springs site (Location 9, Frame G). As Crook and others (2017) commented about this collection, which contains some 40 San Patrice points, "Most of the San Patrice points show no fluorescence under UV light [used to indicate Edwards chert, among other things] and probably source from a closer region, either East Texas and/or western Louisiana. These projectile points have a dull, waxy luster and show traces of extensive heat-treating of the toolstone prior to knapping [such heat treatment is thought to have aided knapping]." The point at upper right in Figure 10.10 is indicative of heat treatment. The point at lower right is made of fossilized palm wood. Significantly, there is no indication of materials from the Lower or Upper Mississippi Valley, which suggests, along with the central Texas origin of most points, that San Patrice people were not recent immigrants from the Mississippi region.

San Patrice points are found throughout the rivers of the joined San Jacinto-Trinity-Sabine-Calcasieu-Mermentau paleo-river system shown in Frame G, and also in the Red River drainage basin extending into parts of Oklahoma, Arkansas, and Missouri (Jennings 2008). Jennings placed the range of the San Patrice occupational period at the well-stratified Big Eddy site in Missouri at 9,800 to 10,500 rcyBP (approximately 11,200 to 12,700 BP), and possibly younger. Story (1990) placed a range on San Patrice of 9,300 and 10,200 rcyBP from work in East Texas. Patterson and Hudgins (1985) reported a San Patrice radiocarbon date of 9,920 rcyBP at 41WH19 in the San Bernard Prairie. There are numerous San Patrice sites along the San Jacinto, Trinity, Neches, and Sabine rivers in Texas, where the lifestyle of fishing and hunting continued probably unchanged from Clovis time, when the area was (perhaps) first occupied. As mentioned earlier, this growing San Patrice presence spilled over into the adjacent Katy and San Bernard prairie (locations 4–7, Frame G), suggesting that San Patrice hunters, based in the Southeast Texas rivers and perhaps the now offshore coastal zone, ventured into the prairies during seasonal bison migration (also see Jennings 2008), jostling for space with the occasional Folsom-wielding hunting party from central Texas. San Patrice hunters visited a greater number of sites than did Folsom hunters along Cypress Creek (location 5), re-occupied and expanded sites in the upper Buffalo Bayou tributaries (location 6), established new sites at White Oak Bayou, and visited the same sites in the San Bernard Prairie (location 4) and Orchard Dome (location 10) as did Folsom hunters.

This pattern of occupation and the form and provenance of San Patrice points suggest that a vigorous culture had grown in the large river floodplain lifeway zone from smaller Clovis beginnings (Patterson 1996). Points had been adapted to smaller, locally available lithic material. Population grew as people adapted to the rich riverine environment—and perhaps as a result too of the new brackish-water fisheries at the bay that joined all the area's rivers, although that is, at present, an undocumented conjecture. Both the river fisheries and the brackish bay resources would have been available year-round, and presumably through periodic dry periods as well—their refugium. Nonetheless, seasonally migrating bison were an abundant resource not to be missed, and Trinity-Sabine Tradition people wielding San Patrice tools likely pursued them from all points of their forested periphery.

### 10,000 BP, end Late Paleoindian (Frame H, Atlas IV)

Following the end of the Younger Dryas cooling, and with it the end of the Pleistocene Epoch, temperatures began to warm again, both globally and in Texas (Figures 10.2, 3.15). With the warmer temperatures came a mixed period of periodic moist and dry precipitation conditions as the climate generally dried from the previous moist, glacial climate (Figure 10.2, after Wong et al. 2015). Texas, and the globe in general, entered a Holocene time of remarkably stable temperatures (Marcott et al. 2013, Wong et al. 2015). By the end of the Late Paleoindian Period, three types of points from the Paleoindian Great Plains Tradition are found in Southeast Texas (Atlas IV, Frame G): Plainview, Scottsbluff, and Angostura. Each of these styles is found throughout the Great Plains (Atlas II, Frame 3). Scottsbluff is a relatively rare type in Southeast Texas, but Plainview and Angostura are common in the sites

of the Katy and San Bernard prairies, and the distribution of each in Texas has a focus along the Balcones Escarpment (Atlas II, Frames 6 and 8). This supports the interpretation that the escarpment was the perennial refugium for the Central Texas Balcones Tradition, and that the Katy and San Bernard (and other) prairies and savannahs of the Texas plains were their bison hunting grounds. None of these three point styles is found in any numbers within the East Texas forest.

The San Patrice point and the culture or cultures that it represents (part of the Trinity-Sabine Tradition) extends into this time, in sites both along the Trinity, Neches, and other rivers within the East Texas forest—their refugium—and in the adjacent prairies, as discussed in the last section. The point locations shown are unchanged from previous Frame H.

With increased warming, sea level rose at a rapid rate (Figure 10.2). The long Trinity-Sabine bay, the drowned former river channel, continued to transgress in an inland direction. In the Trinity River portion, the bay now reached the future position of the modern day coastline; this marks the beginning of Galveston Bay (location 1, Frame H). To the east, the Sabine River (location 2), Calcasieu River (3), and Mermentau River (4) each now has its own bay, as documented by core studies discussed in Chapter 2. Each of these four discrete bays had an estuarine environment where rivers brought in nutrients and provided a brackish near-coast environment seemingly perfect for the development of a rich coastal fishery.

That these now submerged coastal estuaries were inhabited is strongly suggested by the results of an offshore core taken in the late 1980s, on a submerged Deweyville terrace overlooking the then-Sabine River valley (Pearson et al. 1989: location 5). An organic-rich midden was encountered in the core that may have been human-related; a more detailed location is shown in Figure 10.8. Analysis of core samples produced large quantities of charred wood and vegetation, nut hulls, seeds, fish scales, and bones of small mammals, reptiles, and birds. Fish scales in the on-land terrace setting, as well as the charcoal associated with a large variety of bone fragments, strongly suggest that this was a human campsite. Pollen data support a grassy environment with a variety of tree types nearby, as would be expected in a riverine terrace environment. Radiocarbon dates from this soil midden are 8,800 rcyBP, or about 9,900 BP. Overlying the midden is an estuarine deposit containing *Rangia cuneata* shells, indicating the arrival of brackish and marine conditions shortly after the campsite was abandoned—mute evidence of the continued flight of coastal people from rising sea level that must have occurred countless times during the Paleoindian and Archaic periods. The paleogeographic setting indicated at this site (Location 5, Frame H) echoes the findings of the coring: the encroaching bays had arrived there by the end of Late Paleoindian time. It seems likely that people in Paleoindian time found these new estuaries, and were using them, although of course this core in itself provides only the scantest of evidence.

## Early and Middle Archaic Periods

### 9,000 BP, beginning of the Early Archaic (Frame I, Atlas IV)

As the climate continued slowly warming, Texas entered a time of sustained dry conditions (Figure 10.2) that constituted a nearly three-millennia-long drought.

It was perhaps the most challenging time ever seen for Native Americans in the region. As Dillehay (1974) observed, there is little or no evidence of bison hunting on the Texas plains in the Early Archaic, and the bison seem to have stayed farther north in the Great Plains. In central Texas, the Hoxie point style is found only in the best-watered parts of the Balcones Escarpment and closely adjacent areas (Collins et al. 2011); it does not extend into the prairies of Southeast Texas. At the Wilson-Leonard site on the escarpment, subsistence activities involve exploitation of aquatic resources (Collins et al. 1998). Bison hunting went on hold. At the beginning of the Early Archaic, Angostura points were already on the wane (Frame H), and by the middle of the Early Archaic they were gone (Figure 10.1); these represent the last of the Great Plains-wide points of the Paleoindian Great Plains Tradition. The Texas plains were relatively quiet.

What of the Trinity-Sabine Tradition at this time? As the map of Frame H and the chronology in Figure 10.1 show, there is scant temporally calibrated lithic evidence of the tradition at this time of great drought. Here we are hampered by the nature of archeological finds in the rivers of the East Texas forest. As previously mentioned (Chapter 6), the acid, eroding soils are hard on soil middens, and most finds are surface collections—lithic points left behind as lag as all else is eroded away. Most of the dating of such material is from adjacent areas outside the deep forest, such as the Katy and San Bernard prairies to the southwest, or the prairie and savannah of northeast Texas along the upstream parts of the Trinity and Sabine, outside the East Texas forest. There, points from the Trinity-Sabine Tradition can be stratigraphically compared with Central Texas Balcones points, or radiometrically dated by association with accompanying bits of bone and charcoal. With no appreciable bison hunting occurring on the prairies at this time, the hunters of neither tradition seem to have been there. Thus, we do not know if San Patrice points might have extended a little longer in time, or whether later Carrollton points started earlier than shown in the chronology. What we can surmise, however, is that there would have been people continuing to live in their refugia along the Trinity and Sabine rivers, concentrating on riverine aquatic resources, as did their counterparts along the Balcones Escarpment. Either they used stone points that have yet to be sufficiently well dated, or they used bone and/or gar scales as points (a practice well documented for the Late Archaic and later periods), materials that would have dissolved in the region's acid soils. We can hope for more finds of stratigraphically well-preserved sites in future years.

The coastline in Early Archaic time underwent a substantial modification (Frame I). What had been a long, linear Sabine-Trinity incised paleo-river channel system was now completely flooded, and what had been surrounding peninsulas of land were now a string of offshore islands. The bay that occupied the drowned Trinity River channel had moved farther inland, and marine water was beginning to enter the area of modern Galveston Bay (location 3). The same could be said of what was a bay at the end of the Sabine incised channel (location 4).

The potential for brackish water bay fisheries is still present in the Galveston/Trinity, Sabine, Calcasieu, and Mermentau bays, although they are now much more exposed to the open marine environment. The Colorado and Brazos rivers continued to build sedimentary deltas outward or at least to fill their incised channels,

still denying the formation of bays there. Almost certainly there were people living around proto-Galveston Bay at 9,000 BP, but the evidence is now buried beneath the waters of modern Galveston Bay; rising sea level since the Early Archaic has submerged any evidence of shell midden material of Early Archaic age.

### 7,000 BP, End of Early Archaic (Frame J, Atlas IV)

By 7000 BP the long Texas drought was nearing its end (Figure 10.2), and according to Dillehay (1974), there is little evidence of bison in the Texas plains and prairies at that time (Figure 10.13 and later discussion). In Southeast Texas there is still no sign of returning Central Texas Balcones Tradition hunters, and point styles found all along the Balcones Escarpment at this time, such as Uvalde and Martindale, do not reach into the prairies of Southeast Texas (Atlas II, Frames 10 and 11). Collins (2011) notes that during the Early Archaic period "people were living in the well-watered parts of the live-oak savannah habitats on the Edwards Plateau," rather than hunting bison in the plains. Along the upper Trinity River basin in northeast Texas, however, Carrollton points are found (Atlas II, Frames 22 and 23) that date no younger than about 6,000 BP, along with Trinity points that are as old and perhaps extend younger (Crook 2020a; see discussion, Chapter 7). Both of these Trinity-Sabine Tradition points are found in Southeast Texas along the Trinity and Neches rivers (Frame J) as well as in the Katy and San Bernard prairies. The fact that these points are found in the Katy and San Bernard prairies, during a time when Plains tradition points are not found there, suggests that Trinity-Sabine Tradition people—especially those living on the San Jacinto River—may have been heading into upstream areas on tributaries like Cypress Creek and Buffalo Bayou to hunt and fish, which would take them into the Katy prairie. A faunal study by McClure (1987a) at 41FB37 in the San Bernard Prairie (see discussion, Chapter 7) concludes that their diet consisted of deer, turtles, fish, alligator, and just about any small mammal and reptile that they could catch. No doubt they added to that with mast like acorns, pecans, and walnuts. There are Middle Archaic nutting stones found along the Trinity River, for example (Crook et al. 2017; see Figure 9.13).

Carrollton points (Figure 10.11, bottom row) are typically small to medium-sized chert points with a distinctive "Christmas tree" shape, whereas Trinity points, also typically made from chert, have much weaker shoulders. In both types, the basal portions or notches are ground down to facilitate hafting. The chert is typically from local Southeast Texas gravel sources, like most points of the Trinity-Sabine Tradition (Crook et al. 2017).

By this time, the rate of sea level rise had begun to slow, but the coastline continued to change markedly. Gone were all of the coastal islands save one (at least to the extent known): Sabine Island, known from offshore coring discussed in Chapter 2. The most critical coastline changes were to emerging Galveston Bay. The San Jacinto River was a tributary of the Trinity in all previous maps of Atlas IV. As the former incised channels of these two formerly joined rivers continue to drown with advancing seas, the two channels split into what are now the San Jacinto estuary (location 1, Frame J) and Trinity Bay and its adjoining bayhead delta estuary (location 2). The conjoined area south of these two arms is properly known as Galveston Bay

(3). Small bayhead deltas of the San Jacinto and Trinity estuaries almost certainly were the site of bay fisheries and shell middens, but they have been flooded by the continually rising sea level or buried by delta sediments.

### 5,000 BP, Middle to Late Archaic (Frame K, Atlas IV)

Following the long Early Archaic drought, Texas entered a prolonged period of periodic, mixed intervals of moist and dry climate (Figure 10.2). The rate of sea level rise slowed dramatically, and from this time there is the first unequivocal evidence of the human use of brackish water, bay-related resources. This evidence comes from site 41GV53 on Clear Creek (Frame K, location 1), where a *Rangia cuneata* brackish water clam at the very base of a shell midden yielded a radiocarbon date of 5,340 rcyBP, or about 6,220 BP (late Early Archaic), but overlying human-related artifacts in the brackish water shell midden date as old as Middle Archaic (Patterson et al. 2001). The midden—located a few kilometers west of the projected coastline for that time but well within the twelve-mile (20 km) window of brackish water conditions the lie inland on coastal waterways (see discussion, Chapter 6)—contains younger projectile points and Early Ceramic Period pottery sherds in overlying parts of the midden. Another Middle Archaic midden was found at the head of the San Jacinto estuary, at 41HR72 (location 2). Because of slowing sea level rise, Galveston Bay has grown only marginally relative to the previous Early Archaic Period (compare Frames J and K), and the Trinity, Sabine, and Calcasieu bays are slightly expanded (locations 3, 4, and 5).

Onshore, the hunting of bison and deer on the Katy and San Bernard prairies by people of both the Central Texas Balcones and the Trinity-Sabine traditions has begun anew, as indicated by the mix of Central Texas Balcones and Trinity Sabine Tradition sites in the Katy and San Bernard prairies (Frame K). The Central Texas Balcones tradition is represented by Bell, Wells, and Travis points. Of particular interest are the earliest of these three: Bell points, named for Bell County in central Texas, are associated (along with similar Andice points) with the so-called Calf Creek Horizon, an archeological horizon extending from Oklahoma to central Texas. Bell and Andice points are fairly large points with pronounced, distinctive barbs (Figure 10.12). Lohse and others (2015) dated 13 fragments of bison bones from three Calf Creek-related kill sites in Hays County, near the Balcones Escarpment. The dates cluster tightly from 5,955 to 5,815 cal BP, in the early part of Middle Archaic. Rodrigues and others (2016) report three ages in the range 5,900–5,700 cal BP at the Gault site, closely agreeing with those of Lohse.

Figure 10.11. Trinity (top row) and Carrollton (bottom row) points from the Kyle Collection, Liberty County. Photographs courtesy of Wilson W. Crook, III (Crook et al. 2017).

The predominant points in use at the Calf Creek-related are the Andice/Bell points, and Lohse theorized that the time of that horizon is linked to a brief time of higher rainfall in an otherwise fairly dry Middle Archaic Period. The Texas precipitation model of Wong and others (2015) can be compared with a bison abundance model by Lohse (Middle Archaic and younger) as well as by Collins (2004; Early Ar-

Figure 10.12. A Bell point and a Bell fragment (the barbs and tip are broken off) from the Wood Springs site, 41LB15. From the Kyle Collection, Liberty County. Photographs courte-sy of Wilson W. Crook. III (Crook et al. 2017).

chaic and older), as shown in Figure 10.13. The carefully dated Calf Creek period of bison abundance tracks a brief moist period in Wong's model, supporting Lohse's theory. A prolonged period of low rainfall throughout the Early Archaic period tracks well with the period of Early Archaic bison absence in the Texas archeological record observed by Dillehay and Collins. Several brief episodes of bison abundance in Late Archaic through Late Prehistoric time studied by Lohse seem to track brief moist times in Wong's model, although such detailed comparisons may press the intended limits of resolution and precision in both the bison and precipitation models. The three-way correlation of climate, bison abundance, and projectile point typology is an exciting development in Texas archeology of the past decade, and one senses that there is much more to come in future years from researchers in improving the chronology of all three.

The locations of Middle Archaic Central Texas Balcones Tradition points on the map of Frame K show that Plains tradition hunters have returned to the same sites that were favored by Paleoindian hunters, and yet to be favored by Late Archaic and Late Prehistoric period hunters. In the Katy prairie, they were active on Cypress Creek (location 6), western Buffalo Bayou (7), White Oak Bayou (8), and also at various sites on the San Bernard Prairie (9). Bell points in Southeast Texas are typically made from Edwards chert, further local evidence that these hunters came from central Texas (Patterson 1996), although they might also have tooled up with chert cobbles from the Colorado River. Regional point distribution maps of Middle Archaic Bell, Travis, and Wells points (Atlas II, Frames 12–14) show campsites along the Colorado River, stretching from the Balcones Escarpment to the San Bernard Prairie.

Bell points are also found at the Wood Springs site (location 10) and the McFaddin Ranch site (location 11), finds that, along with the distribution of bison bone in archeological sites (Figure 8.1), support the interpretation that bison entered the area from the Katy and San Bernard prairies and spread out along the coastal zone. Bell-wielding central Texas hunters seem to have pursued bison as far east as McFaddin Beach, which was by this time on the coast.

The Travis point appears temporally with the Nolan point of central Texas, toward the end of the Middle Archaic, when the climate has again become drier (Collins 1995). Travis points are found in Middle Archaic at 41AU37 in Austin County (Hall 1981), and at the 41WH19 site in the San Bernard prairie, where they may reach into the Late Archaic (Patterson et al. 1987). A rare Nolan point was found along White Oak Bayou (41HR279) in a part of the bayou that contained multiple bison remains (McClure 1980).

The Trinity-Sabine Tradition is represented by Trinity points (Figure 10.11), discussed in the previous section. Crook (2020a) indicates that Trinity points range younger than otherwise associated Carrollton points, extending into the Middle Archaic. Trinity points are found along the Trinity River within the East Texas forest as well as at the same Katy Prairie locations visited by Central Texas hunters (Frame K). They are not common in the San Bernard Prairie. Crook and others (2017) note that these points are typically made of local Southeast Texas materials, including quartzite and silicified wood. Lithic tools available in the Middle Archaic included

large scrapers and knives for butchering game, and small stone manos and metates, perhaps used in grinding seed or red ochre, as well as sandstone "nutting stones" thought to have been used in cracking and grinding nuts (Figure 9.13).

## Late Archaic and Early Ceramic Periods

### 3,000 BP, Late Archaic (Frame L, Atlas II)

The map of Frame L depicts the coastline at 3,000 BP, and the projectile point distributions shown in a range of time from 2,000 to 4,000 BP during the Late Archaic Period (Figure 10.1). Sea level rise by the Late Archaic has slowed very significantly (Figure 10.2). The bays have expanded only slightly farther inland, and by now Galveston Bay (location 1, Frame L) has assumed approximately its modern extent. Galveston Island, an offshore barrier island, has developed (location 2), as has the Padre Island–Mustang Island complex to the southwest (3). The number of shell middens around the rim of Galveston Bay increased (blue hexagons on the map), especially in the Trinity and San Jacinto estuaries, as brackish water conditions reached sites that were formerly inland areas. The Sabine and Calcasieu bays (locations 4 and 5) had grown significantly inland and were still open to the ocean. By Late Prehistoric time they were trapped by developing beach sand ridges of the modern Chenier Plain and became brackish water lakes (next section).

In the Late Archaic record, there are signs of rapid change in the extent of human occupation, even before the arrival of ceramics in the Early Ceramic Period or the arrival of bow and arrow technology in the Late Prehistoric Periods, both still in the future. As the map in Frame L shows, there is a sharp increase in numbers of archeological sites at this time, which is typically explained as a general population increase. As was discussed in Chapter 5 (see chart, Figure 5.13), there are 62 inland Middle Archaic sites in the Southeast Texas study area (inland meaning areas without marine shell middens), but 216 inland Late Archaic sites, and 211 Late Prehistoric sites. Accordingly, it is typically assumed that the Native American population by the end of Late Archaic time is sharply rising (Patterson 1991; Aten 1983). There is also a sharp increase in numbers of marine shell middens in the coastal zone as sea level stabilizes; Late Archaic sites in the brackish water zone are still observable today rather than being submerged by continuing rapid sea level rise, as in the past. There have been two marine shell middens found in the Middle Archaic, 37 in the Late Archaic, 70 in the Early Ceramic, and 133 in the Late Prehistoric (Figure 5.13). The rate of increase of midden sites is larger than that of numbers of inland sites. As sea level rise after Late Archaic time slows to a crawl, much of this increase might be considered as an indicator that population growth was greatest in the coastal lifeway zone. The climate was becoming somewhat more moist, providing more opportunities for finding bison on the prairies (Figure 10.13). In addition, the area was increasingly affected by Woodlands cultures from Louisiana and other parts of the Lower Mississippi Valley, as evidenced by exotic artifacts from far outside the area, like boatstones, stone gorgets, and copper awls and ornaments. These cultural effects, which also included the arrival of ceramics in the succeeding Early Ceramic period, are significant and are the subject of more detailed treatment in Chapter 11. Early Ceramic period projectile points are largely similar to those of the Late Archa-

ic (Figure 10.1), because there is not a large change in sea level, so the Early Ceramic Period is not treated with a map frame in Atlas IV nor discussed further here.

In the interior, the growth in numbers of archeological sites is very pronounced along the Trinity River, and that growth increases along the San Jacinto and Neches rivers as well. In these areas, the prominent point styles of the era are Gary, Kent, Pontchartrain, and Yarbrough, all of the Trinity-Sabine Tradition (Frame L). These designs are found not only along the big rivers in the East Texas forest but also in the Katy and San Bernard hunting zones—the same prairie places along Cypress Creek, upper Buffalo Bayou, White Oak Bayou, and the San Bernard River/West Bernard Creek junction that by now have been hunted since Paleoindian time. It is, however, a Trinity-Sabine Tradition on steroids, as the more regional projectile point distribution maps in Atlas II, Frames 25–27 show. Gary and Yarbrough points have exploded out of their East Texas forest refugium and range far to the north and west, much farther and in greater numbers than their Carrollton and San Patrice predecessors ever did. Yarbrough is especially expansive in this regard, reaching all the way to the Balcones Escarpment and the Edwards outcrop. Nearly all counties of the Texas plains lying between the Balcones Escarpment and the East Texas forest contain sites with these points, suggesting strongly that bison were widely available.

Patterson (1996) noted that the many point types of the time (see chart, Figure

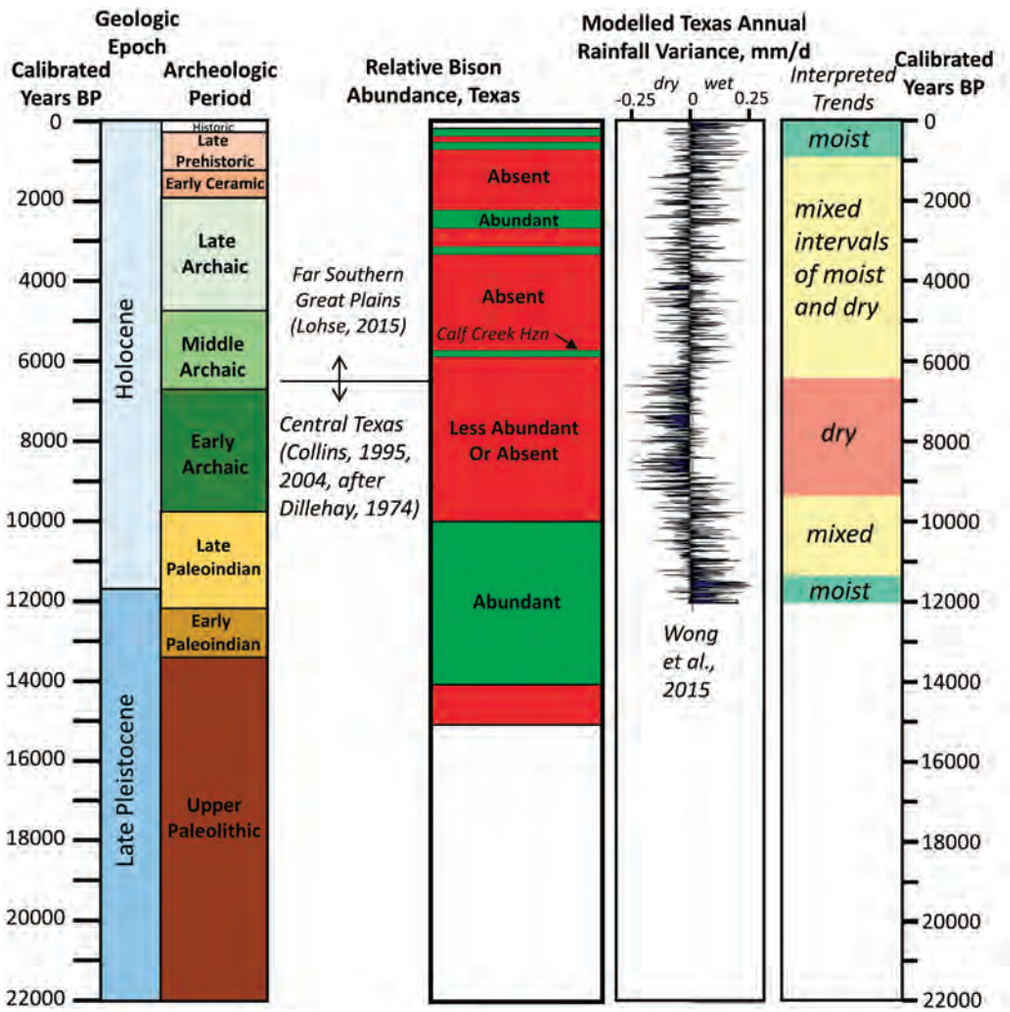



Figure 10.13. Bison abundance vs. climate, Texas and the southern Great Plains. The central column shows pe-riods of bison abundance (green) and general absence (red) according to the work of Lohse (2015) for Middle Ar-chaic and younger periods, and that of Collins (2004; after Dillehay 1974) for Early Archaic and older periods. The precipitation model of Wong and others (2015) displays a long Early Archaic drought that Dillehay associated with bison absence in the southern Great Plains (Texas) archeo-logic record. The Calf Creek Horizon of bison abundance (when the Bell/Andice point was prominent) tracks a prominent moist period at about 5900 BP. Other later periods of abundance generally appear to track brief moist periods, although such detailed comparisons may exceed the intended resolution and precision of both the abundance and precipitation models.

10.1) are often found at the same sites, and that the wide variety of types may be manufacturing variations of point types rather than points of distinctly different cultural groups. For example, as Patterson notes, the removal of a few flakes from a Kent Point will make a Gary point; these are the two most dominant styles of the Late Archaic. Indeed, the mapped distribution of Gary and Yarbrough points is very similar (Atlas II, Frames 25 and 26). Crook and others (2017) note that most lithic artifacts of this era in the Liberty County area, in the Trinity River heartland of the Southeast Texas Eastern Woodlands tradition, are made of local materials. Gary points tend to be made of quartzite from cobbles gathered from local rivers, and lithic tools tend to be made of locally available silicified wood. Figure 10.14 shows examples of Late Archaic points from Liberty County, including some that are made from silicified wood and of quartzite. If people wielding Gary and Yarbrough tools are expanding outward, they seem to be doing it with East Texas-made points. Crook notes that lithic tools of the time—scrapers, gravers, and drills associated with butchering wild game—are quite similar to those of the Middle Archaic. Other tools (manos and nutting stones) continue to show some degree of reliance on seeds and nuts in the diet, as in the Middle Archaic. There is seemingly no lifestyle change in the Trinity-Sabine Tradition area that propels a sharp population growth.

Central Texas Balcones Tradition hunters were very active at this time in both the Katy and San Bernard prairies, as they had been in centuries and millennia past (Frame L). The Pedernales Point is found in large numbers throughout the prairie areas. Regionally (Frame 15, Atlas II), its distribution has a strong focus along the Balcones Escarpment, the refugium of its users, but fans out in all directions, including the Southeast Texas prairies. Collins (2011) notes that this was a time of moist climate and bison abundance. Lohse's dating of bison presence is the most precise, and he records two periods of abundance in the Late Archaic, at ca. 3,295–3,130 and 2,700–2,150 cal BP, from sites in Hays County, along the Balcones Escarpment, as well as the Gault site in Bell County. These two periods that are depicted in the bison abundance chart of Figure 10.13 are generally consistent with times of moist conditions of Wong's (2015) precipitation model; the earlier of the two seems consistent with the time of the Pedernales point.

The Fairland point is placed toward the end of the Late Archaic by Collins (1995). Its regional distribution pattern (Frame 17, Atlas II) is nowhere near as expansive as that of the Pedernales, suggesting that by the end of the Late Archaic the climate was drying, and bison abundance may have been on the wane. Fairland points are found in Southeast Texas only in the San Bernard Prairie; they did not reach the Katy Prairie. During this Late Archaic time period, hunters from the Central Coast-South Texas Tradition were also hunting in the Katy and San Bernard prairies (Frame L). Their point styles include the Morhiss, which is found mostly along the central coast, and Refugio, a South Texas style that ranges as far northeast as these locations.

It is difficult to look at these maps and not envision conflict between the hunters of the three traditions within the narrow corridors in which lie the Katy and San Bernard prairies. In these two prairies and along the rim

Figure 10.14. Projectile points of the Late Archaic Period, from the Andy Kyle Collection (Crook et al. 2017). Photos courtesy of Wilson W. Crook, III.

of the immediately adjacent parts of the Brazos and Colorado rivers are a number of Late Archaic cemeteries, discussed in detail in Chapter 11. Eleven burials in those cemeteries show evidence of violent death, and among the projectile points used in those deaths were Gary, Kent, and Yarbrough of the Trinity-Sabine Tradition, and Fairland and Bulverde points of the Central Texas Balcones Tradition. There were no Central Coast-South Texas Tradition points observed in these deaths, which along with other artifact information leads to the tentative conclusion that the San Bernard Prairie was part of proto-Karankawan territory, as it was in Early Historic Period, and that the Central Texas Balcones and Trinity-Sabine Tradition hunters were interlopers (see Chapter 11). It would seem that populations of all three had increased markedly over previous times, judging from the vastly increased numbers of archeological sites. At the same time, these points are found at a time of relative bison abundance. Many thousands to perhaps millions of animals hunted by a few thousand people (see population discussion, Chapter 4) over a very large area need not imply *constant* conflict, as no group could inhabit all of that vast space during any one season. Nonetheless, the deadly encounter during the early Historic Period of Akokisa bison hunters with "Toyal" Indians in the Katy Prairie in 1719 (Chapter 4), where both groups were hunting bison in the same general area, suggests that conflict, however infrequent, was inevitable.

## Late Prehistoric Period

### 1,400 to 400 BP, Late Prehistoric to the beginning of the Early Historic (Frame M, Atlas II)

By beginning of Late Prehistoric time, sea level had essentially reached its modern level, and coastal outlines of the present day (Frame M, Atlas II) can serve as a base map for Late Prehistoric projectile point distributions. By most accounts, the long Holocene interstadial period of warming following the Last Glacial Maximum was coming to a close by the early Historic Period, and sea level rise had slowed to a crawl (Figure 10.2). In Southeast Texas the beginning of the Late Archaic period is measured by the time of arrival of the bow and arrow, estimated in the Galveston Bay area at ca. 1,400 BP (AD 600) by Aten (1983). The number of archeological sites has reached an all time high of 344 coastal and inland sites, vs. 271 during the Early Ceramic Period, and 253 during the Late Archaic (3,500 BP, or 1,500 BC; see Figure 5.13). The number of coastal shell middens has also increased significantly since the Late Prehistoric, as can be seen on Frame M. Coastal resources are being harvested not only at Galveston Bay and Sabine Lake but at the brackish water termini of many small coastal rivers.

Most of the growth in the number of archeological sites (which presumably is at least a partial proxy for population growth) in Early Ceramic and Late Prehistoric time is likely the result of the arrival of new technologies—principally ceramics for cooking and food storage and more accurate, powerful bow and arrows for hunting, but the abundant moisture and bison of the period are also a likely factor (Figure 10.13). Dillehay (1974), Collins (1995), and Lohse and others (2015) all note a time of relative absence of bison on the Texas plains in the Early Ceramic, which was followed by a return of bison in the Late Prehistoric Period; this seems to be reflect-

ed in the smaller numbers of Early Ceramic sites relative to the bookending Late Archaic and Late Prehistoric periods. Lohse's measurements are that a new wave of bison coming from the north took place in the Late Prehistoric Period in the central and southern Texas plains at 650 cal BP (AD 1300), and that it lasted until 530 cal BP (AD 1470), not long before the beginning of the Historic period.

The excavation of the well-stratified Early Ceramic and Late Prehistoric site at Alabonson Road (41HR273) along White Oak Bayou in the Katy Prairie revealed bison bones only in the uppermost levels of the site, with no bison (and abundant deer) in the lower, Early Ceramic portion (Ensor and Carlson 1991). This finding is consistent with Lohse's observation in central and southern Texas that bison were absent in the Early Ceramic, and that they returned in the Late Prehistoric. Nearby along that bayou are several Late Prehistoric bison kill sites in gullies and along the main White Oak Bayou channel (Chapter 8). At one of these sites (41HR406) a single bison kill was associated with a Perdiz arrow point (Fields et al. 1988). Nearby upstream, at an unnumbered site, imbedded Perdiz, Catahoula, and Fresno arrow points were found in another single kill (Dickens 1984). At nearby 41HR541, another single kill was associated with both Perdiz and Alba-like points. A radiocarbon date of bone and associated charcoal at that site yielded an age estimated from AD 1300 to 1700 (McReynolds et al. 1988; Ensor 1990). Late Prehistoric sites are associated with bison remains at several other sites in the Katy and San Bernard prairies, as discussed in Chapter 8.

Many ethnohistoric records—especially those of early French visitors—also record the presence of bison in Southeast Texas and along the central Texas coast during the late seventeenth and much of the eighteenth centuries. The last known large herds of bison in Southeast Texas were seen in the San Bernard and Katy prairies at the time of the Texas Revolution in 1836 (see Chapter 4). Early settler Dilue Harris wrote in March 1836 that "a large herd of buffaloes came by. There were three or four thousand of them. They crossed the Brazos River above Fort Bend, and came out of the bottom at Stafford's Point, making their first appearance before day" (Harris 1900). This crossing led them from the San Bernard Prairie into the Katy Prairie.

As was the case in the Late Prehistoric Period, projectile points (now arrow points) from all three traditions are found in the Southeast Texas area (Frame M). Central Texas Balcones Tradition Edwards points are found in the San Bernard and Katy prairies. Alba and Catahoula points, associated with the Trinity-Sabine Tradition, are found at numerous sites lining the Trinity River banks as well as along parts of the San Jacinto and Neches rivers, in the East Texas forest, as well as extensively in the Katy and San Bernard prairies. Lastly, points of the Central Coast-South Texas Tradition are well represented, but sparingly, by Catán and Guerrero points, the latter connected with Early Historic Period mission sites in Central and South Texas, including Goliad and the San Antonio missions as well as Post San Bernard, an active Texian fort in the San Bernard Prairie during the Karankawa disturbance and dislocations of the 1820s and 1830s (Chapters 4 and 7). The Catán has a unique distribution, focused in the Rio Grande Valley with likely associations with Coahuiltecans (Atlas II, Frame 34). Several minor arrow point types are found in Late Prehistoric and early Historic Period sites along Peach Creek in the San Ber-

nard Prairie, including the Cuney, Bulbar Stem, and Lozenge (Patterson 1996). The Lozenge and Catán are associated with Coco (Karankawa) Historic era sites there, along with Guerrero points (Figure 8.33).

The Perdiz and Scallorn, however, are by far the most commonly found arrow points in Southeast Texas, followed by the Catahoula and Alba (Figure 10.15). The Scallorn point, dated in central Texas at ca. 850 BP (Turner et al. 2011), is found in the early part of the Late Prehistoric in central Texas (Collins 1995), along with the Edwards point. It has a very expansive regional distribution seen loosely rooted in central Texas, and shares that expansiveness with the Perdiz (Atlas II, Frames 37–39). Both point types reach from far West Texas to Louisiana, and the Scallorn reaches farther still, into Kansas and Missouri and the upper Mississippi Valley. As mentioned in Chapter 7, these types were very likely to have been copied by various cultures and used in regional trade; the Scallorn in particular was a very early arrow point type and may have been part of the early spread of bow and arrow technology.

The Alba and Catahoula types of the Trinity-Sabine Tradition reach far into Louisiana, and the Catahoula has been found in the Lower Mississippi Valley as far as northeast Arkansas (Atlas II, Frames 20, 28, and 29). They give evidence, along with slightly earlier Late Archaic to Early Ceramic Period dart points as well as aforementioned exotic artifacts of the region, to the profound effects of mound cultures of the Lower Mississippi Valley on this region (Chapter 11).

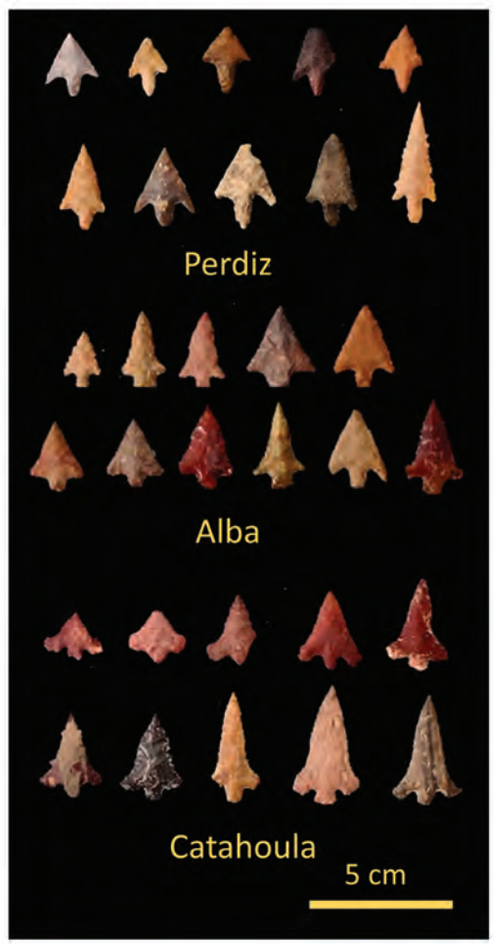



Figure 10.15. Arrow points of the Late Prehistoric Period, from the Andy Kyle Collection (Crook et al. 2017). Photos courtesy of Wilson W. Crook, III.

## Origins of Atakapan and Karankawan culture

With the arrival of the Early Historic Period, a veil of sorts is lifted, whereby archeologists and historians can affix clear names of historic cultural groups to the most recent manifestations of the three traditions heretofore discussed, as shown in Frame N of Atlas IV. The most recent cultures of the western part of the Trinity-Sabine Tradition include the Atakapa and their various bands in Southeast Texas and southwestern Louisiana. The Central Coast-South Texas Tradition is represented by the Karankawa, including their most northeastern band, the Coco, who lived along what is now the Matagorda County coast as well as, seasonally, in the San Bernard Prairie. Finally, the interior plains in the Early Historic Period contained roving groups of Tonkawa bison hunters, a cultural group with a complicated history thought to have arrived in the area from the Texas High Plains in between the Balcones Escarpment and the western part of the coastal prairies only by the seventeenth century. There they apparently merged with small fragmented groups of that region that likely contained remaining descendants of people of the fourteenth-century Toyah archeological phase; all this plains movement was greatly impacted by the acquisition of the horse, by spread of infectious diseases, and by other effects of early Spanish incursions in the Southwest (Carlisle 2010; Kenmotsu and Boyd 2012). It may be useful to think of the recently arriving Tonkawa as the latest heirs of the Central Texas Tradition, but it is perhaps more useful to

think of the Toyah culture in that regard.

In the summary of Chapter 7, a model was presented that showed three great regional traditions active in the Southeast Texas area from Late Paleoindian through Early Historic time (Atlas II, Frame 46). Plains and prairie bison hunters of all three traditions (Central Texas Balcones, Trinity-Sabine, and Central Coast-South Texas) hunted periodically in the Katy and San Bernard prairies, as conditions permitted. Each of the three groups is interpreted to have had a separate refugium: the Balcones Escarpment, the rivers of the East Texas Forest, and the river-fed bays of the central coast. Only one of those refugia was in Southeast Texas, and in the Early Historic Period it was inhabited by the Atakapa. Here we take the summed results of the preceding paleogeographic maps to press the interpretation of the Atakapa further and assess their possible origins, deep in prehistory.

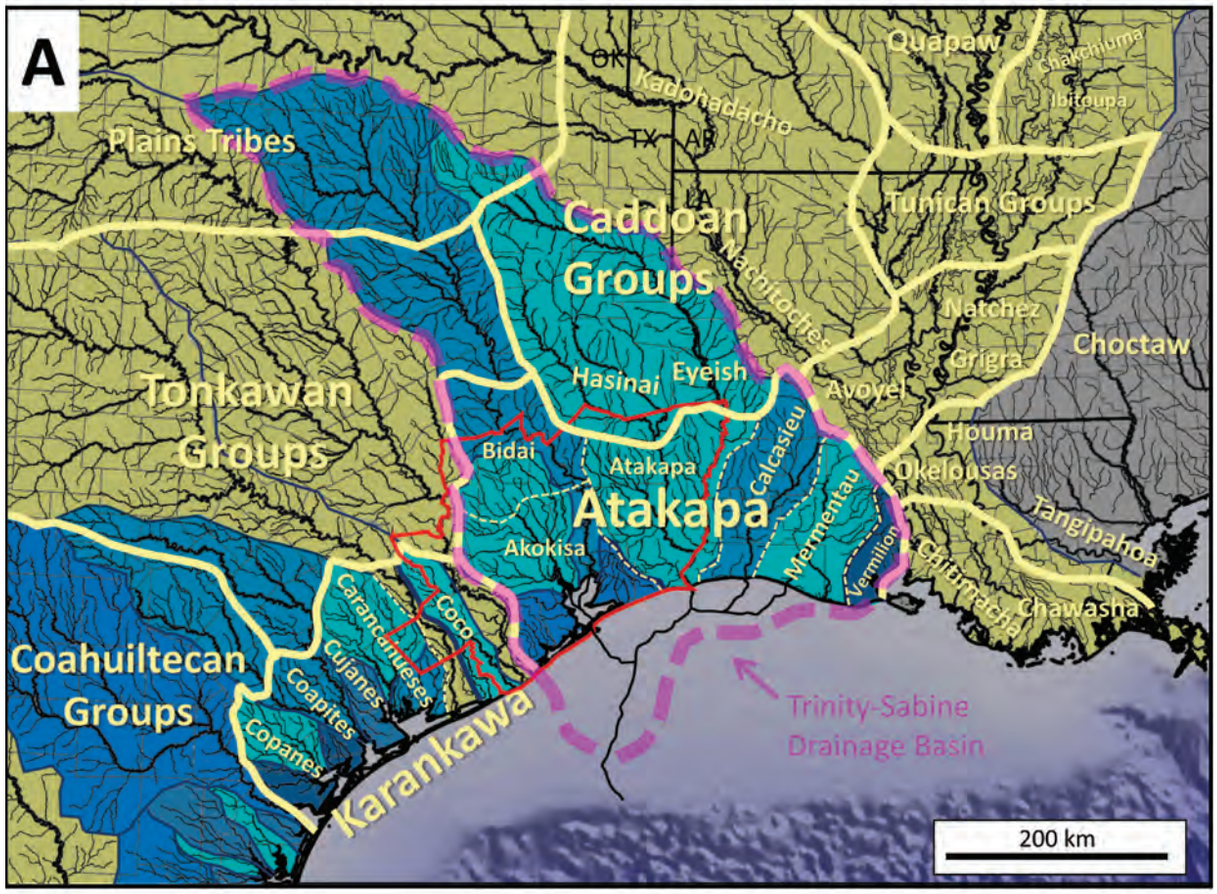
The Atakapa were hunter-gatherers, and had been so throughout their recorded history. As was mentioned earlier, Patterson, Story, and most other researchers have regarded the long-occupied sites of this region as evidence of a cultural continuum of hunter-gatherer activities going back for millennia. As Patterson (1986) put it, "a stable nomadic hunting and gathering lifeway is indicated for the entire time period. A single type of lifeway and a stable settlement pattern continued from the Late Paleoindian period until European contact at the end of the Late Prehistoric . . . in spite of any possible climate variations." Taken at face value, and separating out the visitors from central Texas and the central coast to the prairies of the area, this results in the reasonable assumption that the Atakapa have very deep roots in Southeast Texas. These people and their predecessors lived along the San Jacinto, Trinity, and Sabine-Neches rivers as well as the Calcasieu and Mermentau of coastal southwest Louisiana (Figure 10.16A), where they fished, hunted, caught alligators and turtles, gathered nuts and fruits, and generally lead a riverine hunter-gatherer lifestyle that changed little from Late Paleoindian through Late Prehistoric time. Log canoes, introduced at least by Archaic time, facilitated rapid transport and communication up and down each river. This riverine heart of their world constituted their refugium (yellow shading on Figure 10.16B). Their surrounding prairie areas were hunted not only by them but by coeval Central Texas Balcones and Central Coast-South Texas hunters, as the sites in the Katy Prairie demonstrate, but the archeological record and the maps of Atlas IV show that their East Texas forest-enclosed river floodplain refugium was generally theirs alone. As the discussion in Chapter 11 will show, their refugium included parts of the Trinity, Neches, and Sabine rivers far north of their final northern boundary in the Early Historic Period mapped by Swanton (Figure 10.16A). Expansion of Caddoan people in the Late Prehistoric period restricted their refugium to the southern half of the East Texas forest (blue line, Figure 10.16B, and discussion in Chapter 11).

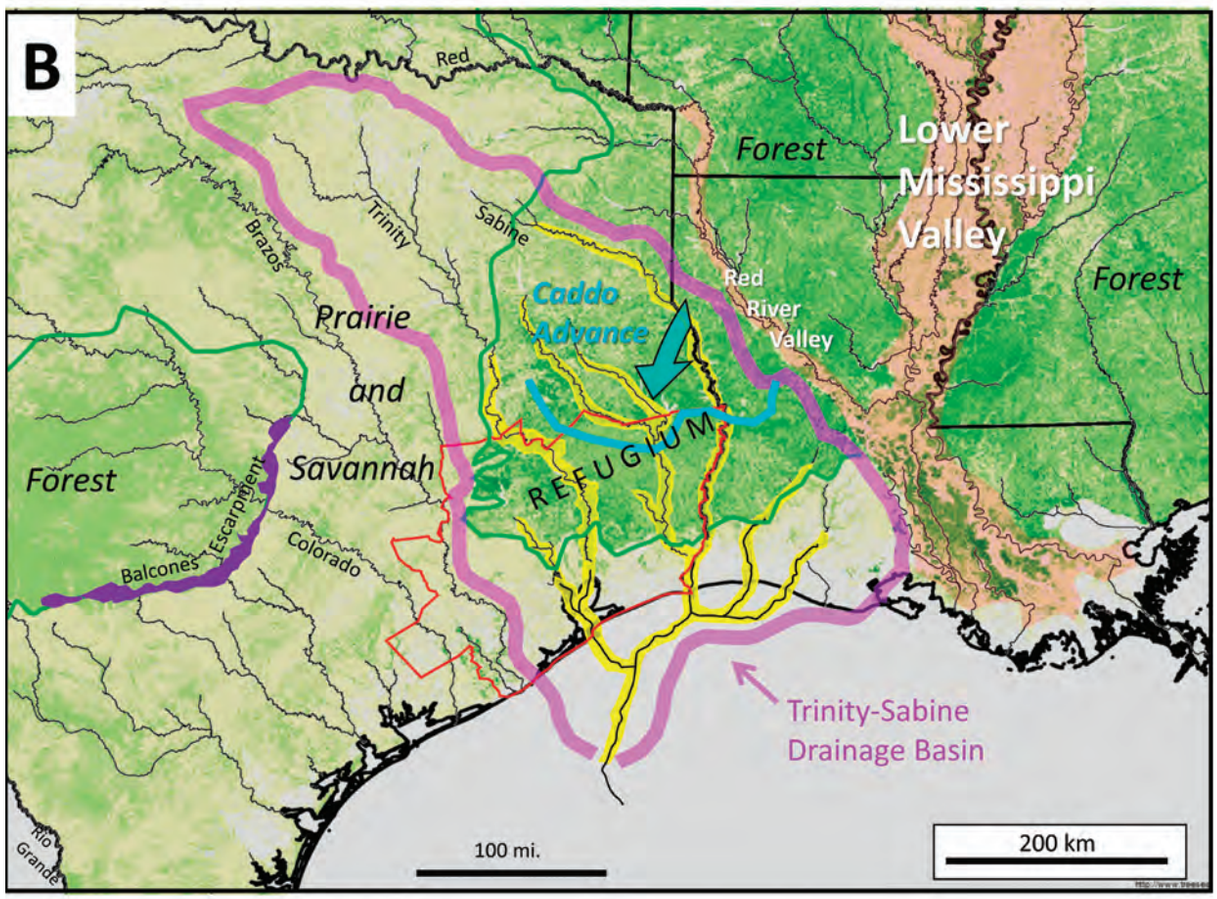
The San Jacinto, Trinity, and Sabine-Neches also have bay estuaries or brackish water lakes at their mouths along the coast that were favored places for fishing and shell-fishing. Occupied shell middens date back only to the Middle Archaic, because sea level rise has submerged the coastal terrain that dates to earlier periods. In the Early Historic Period, ethnohistoric accounts show that the various bands of the Atakapa frequented these bay fisheries for much of the spring and summer.

Because these were predominantly riverine people—their archeological sites

Figure 10.16. A. Major Native Amer-ican cultural groups, ca. 1700, as depicted by Swanton (1911, 1952) and as earlier depicted in Figure 4.1. Boundaries are superimposed upon river drainage basins, as per Figure 1.2. Broad pink line highlights the greater Trinity-Sabine drainage basin and its original offshore extent. Extensions of once-joined Trinity, Sabine, Calcasieu and Mermentau rivers are shown in the modern offshore zone.

B. Same area, with underlay representing intensity of forest cover, from Wilson and others (2013), U.S. Forest Service. Modern forests are intense green, and plains, prairies and savannahs are yellow to mottled. Bright green lines highlight the general forest-prairie boundary. Blue line represents southern limit of the Caddo advance into the region during the Late Prehistoric Period, which is equivalent to the northern boundary of the Atakapa in the Early Historic period as mapped by Swanton (see A). Dark purple area represents the outcrop area of the Edwards forma-tion at the Balcones Escarpment. The interpreted refugium of the Trinity-Sabine Tradition once included the river valleys of the San Jacinto, Trinity, Sabine and Neches rivers (in yellow) where they lay within the East Texas forest.


A
OK
TX
AR
LA
Quapaw
Shakchiuma
Ibitoupa
Kadohadacho
Plains Tribes
Caddoan Groups
Natchitoches
Tunican Groups
Natchez
Grigra
Choctaw
Avoyel
Hasinai
Eyeish
Tonkawan Groups
Bidai
Atakapa
Atakapa
Calcasieu
Houma
Okelousas
Mermentau
Vermilion
Tangipahoa
Akokisa
Chitimacha
Chawasha
Carancahueses
Coco
Coahuiltecan Groups
Cujanes
Coapites
Copanes
Karankawa
Trinity-Sabine Drainage Basin
200 km


B
Red
Forest
Lower Mississippi Valley
Forest
Trinity
Brazos
Sabine
Caddo Advance
Red River Valley
Prairie and Savannah
Forest
REFUGIUM
Escarpment
Balcones
Colorado
Trinity-Sabine Drainage Basin
Rio Grande
100 mi.
200 km

line rivers and bayous, and ethnohistorical accounts place them on these rivers—the situation of their various cultural boundaries on drainage basin boundaries is to be expected (Figure 10.16A). The Atakapa's eastern edge as observed by Swanton (1911, 1952) was the mutual edge of the Sabine River basin and the Lower Mississippi Valley, including its Red River tributary (Figure 10.16A and B). This was a firm cultural and language boundary. To the east lay LMV cultural groups with vastly different languages than the Atakapa, as was discussed in Chapter 4. Whereas the Atakapa had one language over a fairly large amount of territory, the LMV cultures with their various languages and language groups were much smaller in territory, probably a legacy of millennia of various mound cultures with specific cultural centers. The western boundary of the Atakapa territory was the boundary between the San Jacinto River basin to the east and the Brazos River basin to the west. It too was a "hard" language boundary, with nearly no similarities between Karankawan and the Atakapa language or, for that matter, the Tonkawan language to the northwest. To the north, the migrating Caddo also spoke a vastly different language.

The Atakapa language is known as a language isolate, meaning that it is enormously different from the languages of surrounding cultural groups. The differences are not like the minor differences between many European languages, where the word "three" as spoken in various European homelands (drei, trois, tres, trí and so forth) is similar enough to denote a common ancestor in a not too distant past. There are few to no such common root words between Atakapa and Karankawa, or Tonkawa, or Caddo, or Natchez—all neighbors in the early Historic Period. The fact that simple regional drainage basin boundaries coincided with firm language boundaries suggested that the Atakapa had lived within the greater Trinity-Sabine drainage basin for a long time. Had it been otherwise, linguists should be able to find at least some similar words among these various tongues, and that does not appear to be the case (Chapter 4).

Within the Atakapan domain, there were six bands at the time of Spanish records. An additional two—the Patiri and Deadose—were only noted in passing by the Spanish, and of them little is known. The remaining bands each lived in a separate river basin, with the exception of the Bidai, who lived on the upper Trinity (Figure 10.16A). Ethnologists Swanton (1911, 1919) and Gatschet and Swanton (1932) noted that bands of the modern Atakapa each spoke dialects of Atakapan, and could make themselves orally understood to other bands—but not to other tribes outside of Atakapa borders, unless by using sign language. Considering the difficulty of travel across the swampy land that existed between the coastal rivers, and that their log canoes were described as unsuited to open ocean transport, then why should these Atakapan dialects have been so closely similar, when relatively groups in the Lower Mississippi Valley developed such different languages from each other? Might the Atakapan bands also have a common geographic root?

To approach this question, we must consider the paleogeography of the developing coastline following the Last Glacial Maximum (Atlas IV), as well as the nature of now drowned parts of these rivers in the modern continental shelf. As was noted in the preceding discussion, the archeology of this vast area is unknown. However, the pattern of advancing coastlines with rising sea levels gives some clues. In each of paleogeographic map levels B through M of Atlas IV, the parts of the

coastal zone where significant rivers or streams potentially allowed a brackish water estuarine fauna to develop have been colored blue in the various time slice maps. In the summary map of Figure 10.17, these coastal brackish water zones are re-traced, map by map, then colored by relative age and plotted on a single map that shows how the potentially rich brackish water zones migrated with time. Archeological data show that inland parts of the rivers in the greater Trinity-Sabine drainage basins were occupied by Clovis time, as presumably were the southern extensions of these rivers that are now submerged (Atlas IV, Frame E, 13,000 BP). At this time, the San Jacinto, Trinity, Neches, Sabine, Calcasieu, and Mermentau rivers were all tributaries of a single large river system that is here termed the greater Trinity-Sabine (Figure 10.16B). It had the appearance of a many-branched tree that had an outlet at its trunk in the Gulf of Mexico, which is at location 1 of Figure 10.17.

The incised valley of the greater Trinity-Sabine river began to flood by the end of Early Paleoindian time, becoming a bay (Frame F, 12,500 BP). The mouth of the river at the head of the paleo-bay was then at location 2, Figure 10.17. At this time the rivers now known as the San Jacinto, Trinity, Neches, Sabine, Calcasieu, and Mermentau were each still inland tributaries of the greater Trinity-Sabine River system. People who (conjecturally) lived along these river systems could all easily communicate with each other by means of river transport, and they perhaps shared the common bay estuary resource.

This simple geographic situation began to change by Late Paleoindian time (Frame G, 11,500 BP) when rising seas flooded the mouth of the Trinity tributary of the greater Trinity-Sabine. The Trinity and Sabine then became separate river systems, each with its own estuarine mouth in the bay (locations 3a and 3b, Figure 10.17). An open bay now separated the people living on the (still joined) Trinity and San Jacinto rivers from those living along the (still joined) Sabine, Neches, Calcasieu, and Mermentau rivers.

By the end of Paleoindian time (Frame H, Atlas IV, 10,000 BP), there were four distinct bay head estuaries separated by marine water: Trinity, Sabine-Neches, Calcasieu and Mermentau (locations 4a–4d, Figure 10.17). By the Middle Archaic (Frame K, 5,000 BP), each of these four bays faced the open Gulf of Mexico, which might have been dicey to cross in a narrow and low log canoe; ethnographic sources say that Indians tended to stay in protected waters with their craft. Communication between these groups now needed woodland and prairie trails across the interior. Also by Middle Archaic time, the mouth of San Jacinto—formerly an inland tributary of the Trinity—began to flood and developed an estuary that is separate from the mouth of the Trinity, as it is today.

This perpetual process of flooding caused by continually rising seas clearly separated the various rivers of the greater Trinity-Sabine system, and it would seem reasonable to assume that it likewise separated Atakapa groups that once had a common geographic center. That paleogeography is consistent with a cultural development of Atakapan groups from one common stock, and hence one common root language. Location 1 and the area immediately upstream of it is where the first bay formed by drowning of the incised paleo-Sabine river valley, which may have provided a rich brackish water fauna available for harvesting. It would have provided a special cultural focal point, just as it did for the Historic Period Atakapa,

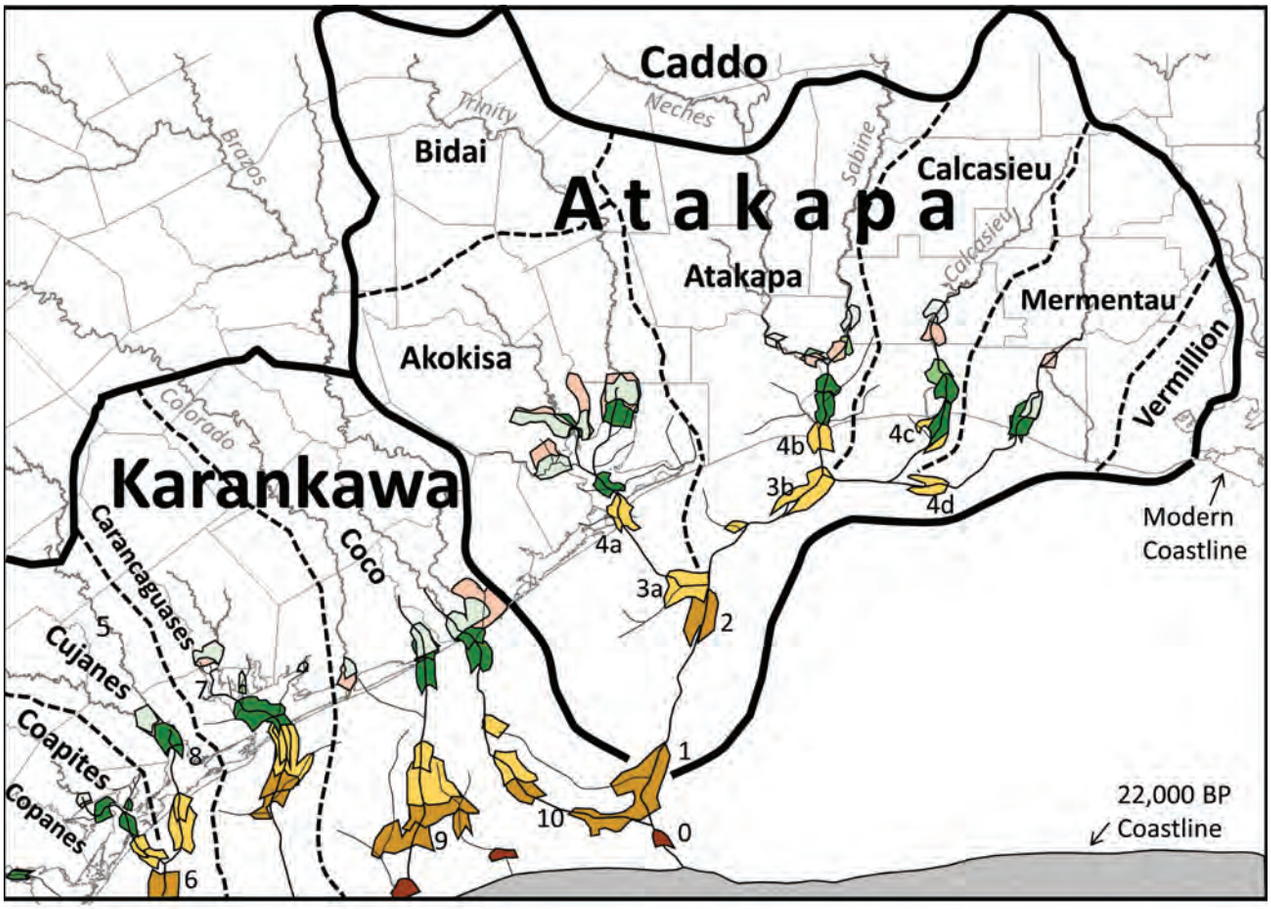
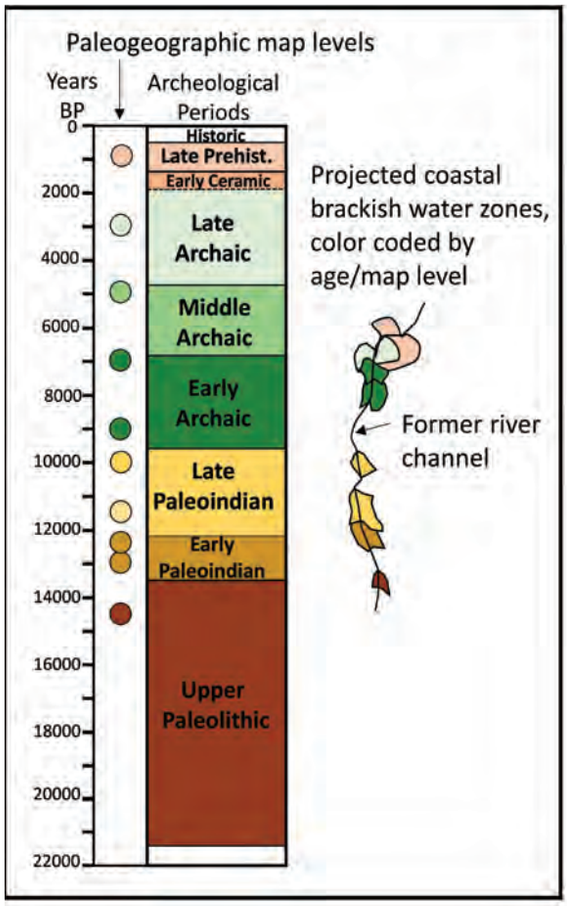



Figure 10.17. Summary map showing the migration of coastal brackish water zones—the locale for shell middens and bay fisheries—through time, as compiled from Atlas IV paleogeographic reconstructions and colored by relative age. These patches show the coastal/marine interface as it migrates inland with continued inundation of the coast by rising sea level; there is a track of such a migrating interface along each river. Also shown are the tribal boundaries of the Atakapa and Karankawan cultural groups of the early Historic Period, as drawn by Swanton (1952) as well as intra-Atakapa band boundaries, adapted and modified from Aten (1983) and ethno-graphic sources discussed in Chapter 4; these are notionally projected offshore for earlier periods.

according to Aten (1983). It would seem reasonable that the roots of the Atakapa language— shared by all the bands of the Atakapa that lived along all the branches of the paleo-Sabine—developed from this post-Clovis population seed. As rising sea level drove these people apart, different bands developed along each river tributary as each tributary separated from the common greater Trinity-Sabine trunk. Language usages began to diverge, but not so much as to make bands unintelligible to one another.

### Karankawan culture

The oldest known archeological sites relating to estuarine resources on the central coast (what would become the Karankawa refugium in the Historic Period) are of Early Archaic age; these lie inland from San Antonio Bay (Ricklis 2004). These sites show that coastal peoples—perhaps proto-Karankawa—were on the central coast by Early Archaic time, but those sites do not preclude an earlier arrival. Projection of Nueces River submergence history due to sea level rise shows that the brackish water zone for Early Paleoindian time would have been much farther southeast, at location 6. In inland positions, Clovis points have been found at the edge of Lavaca Bay at 41CL72 (location 7) and on the banks of the Guadalupe River in Victoria County at 41VT15 (location 8), both positions that were inland at the time. It is not known whether people at these Clovis sites were connected with the Central Coast-South Texas Tradition of the Archaic through Early Historic periods, and such is




beyond the scope of the present study. It is not unreasonable to presume so, however. Coastal dwellers in the estuaries of the Brazos and Colorado rivers, in what are now Matagorda and Brazoria counties—the Coco of the Early Historic Period— hunted in the inland San Bernard Prairie, in between those two rivers, during the Early Ceramic through early Historic periods. Those same San Bernard hunting sites have a record of being hunted back into Clovis (Early Paleoindian) time. If we assume that Clovis hunters settled along the lower Brazos and Colorado rivers, then it seems reasonable to trace the progress of their presumed estuarine resources through time, in similar fashion to that of the proto-Atakapa. The Colorado River delta's estuary in Early Paleoindian time was at location 9 (Figure 10.17), and the Brazos delta at that time was at location 10. The mouths of those rivers were close together then, as they are now. A working hypothesis is that the Coco and the rest of the Karankawa may have developed along those rivers and their coastal estuaries following Early Paleoindian time, at sites now submerged.

Because of the violent extinction of the Karankawa during the Historic Period, we have no linguistic studies of the various bands of Karankawa. Like Atakapan language, Karankawan is considered an isolate. There are only a few ethnohistoric documents from the colonial era indicating that bands of the Karankawa (including the Coco) seemed to be able to converse with each other, plus a few hundred words remembered by a Mrs. Oliver, who befriended a small remnant Karankawan group during her childhood (Gatschet 1891; see Chapter 4).

## Possibilities for future work

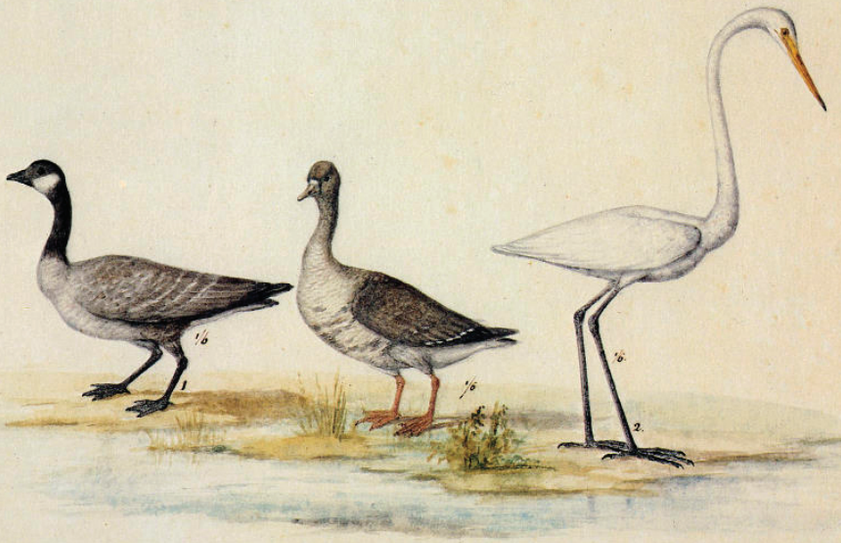
The hypotheses mentioned for the inhabiting of coastal areas by early proto-Atakapa and proto-Karankawa people discussed here are just that—hypotheses. To prove or at least further substantiate them would require more research and resources. An obvious plan of attack, if resources were made available to academic research groups, would be to obtain a close array of high-frequency, near surface seismic data and/or "Chirp" sonar data along the full course of the offshore greater Trinity-Sabine drowned channels. If cultural shell middens developed along the course of these channels during the Late Pleistocene and Early Holocene, as hypothesized, and if these shell midden deposits are as thick and well-developed as those in the modern Trinity estuary (see Chapter 6), then they might be expected to be visible on seismic records as highly reflective patches due to the high acoustic contrast between hard shell and soft encasing mud. These patches would be obvious targets for coring, if they are not too deeply buried by later river (and submarine turbidite) deposits. Any obvious pattern of middens in the rapidly drowning channels could help elucidate shorter frequency changes in the rate of sea level rise.

Because sea level rose fairly rapidly during much of the Late Paleocene and early Archaic periods, it is possible that cultural shell middens did not have time to develop fully, which would yield a failed outcome. The best chances might be found at sites coeval with the Younger Dryas, between the Early and Late Paleoindian periods, when sea level rise temporarily slowed (Figure 10.2).

Coring is an expensive process, and finding projectile points or lithic debris would be like finding a needle in a haystack. Coastal people at this time lived a long way from lithic resources, and as was discussed in Chapter 8, lithic tools are fairly rare in sites in coastal settings. Excavated Trinity estuary Early Ceramic middens (Chapter 6 and Aten 1983) have yielded mostly shells and a few ceramics. There will be no ceramics on the shelf, of course. But large numbers of still-articulated *Rangia* shells would suggest that someone may have cooked and eaten them. With luck, faunal remains (bone) and charcoal might be found that could help pin down potential human occupancy; the more cores taken, the better. Middens can be dated with either radiocarbon or OSL techniques, better dating the timing of the advancing coastline and placing time limits on possible human occupancy. There is much still to be learned from the unexplored offshore zone.

Watercolor of two geese and a crane, from the work of French naturalist Jean Louis Berlandier, who visited the Gulf Coast of northeastern Mexico and Texas in 1830. Image courtesy of the Smithsonian Institution Archives.

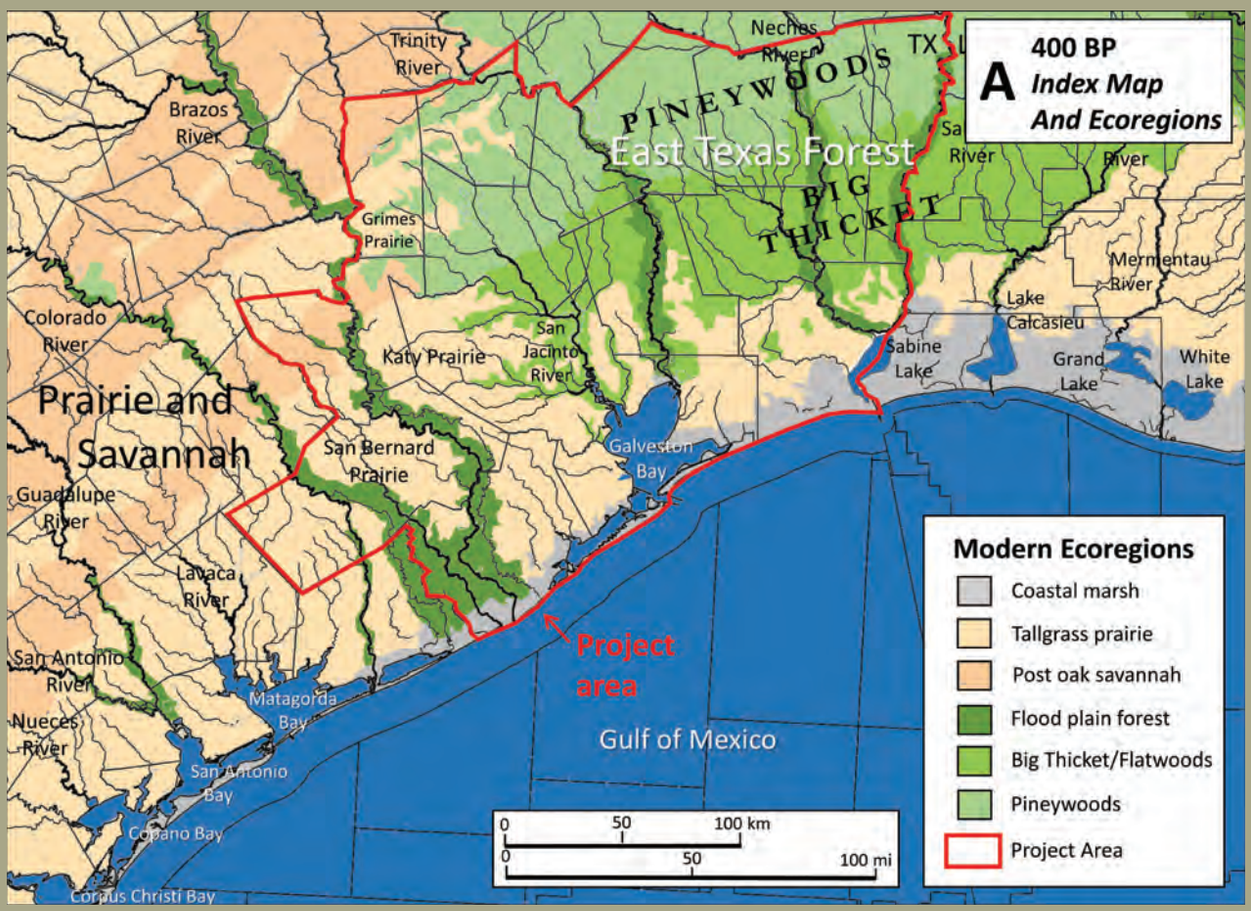
Palmipedes. – Lamellirostres  Grallæ

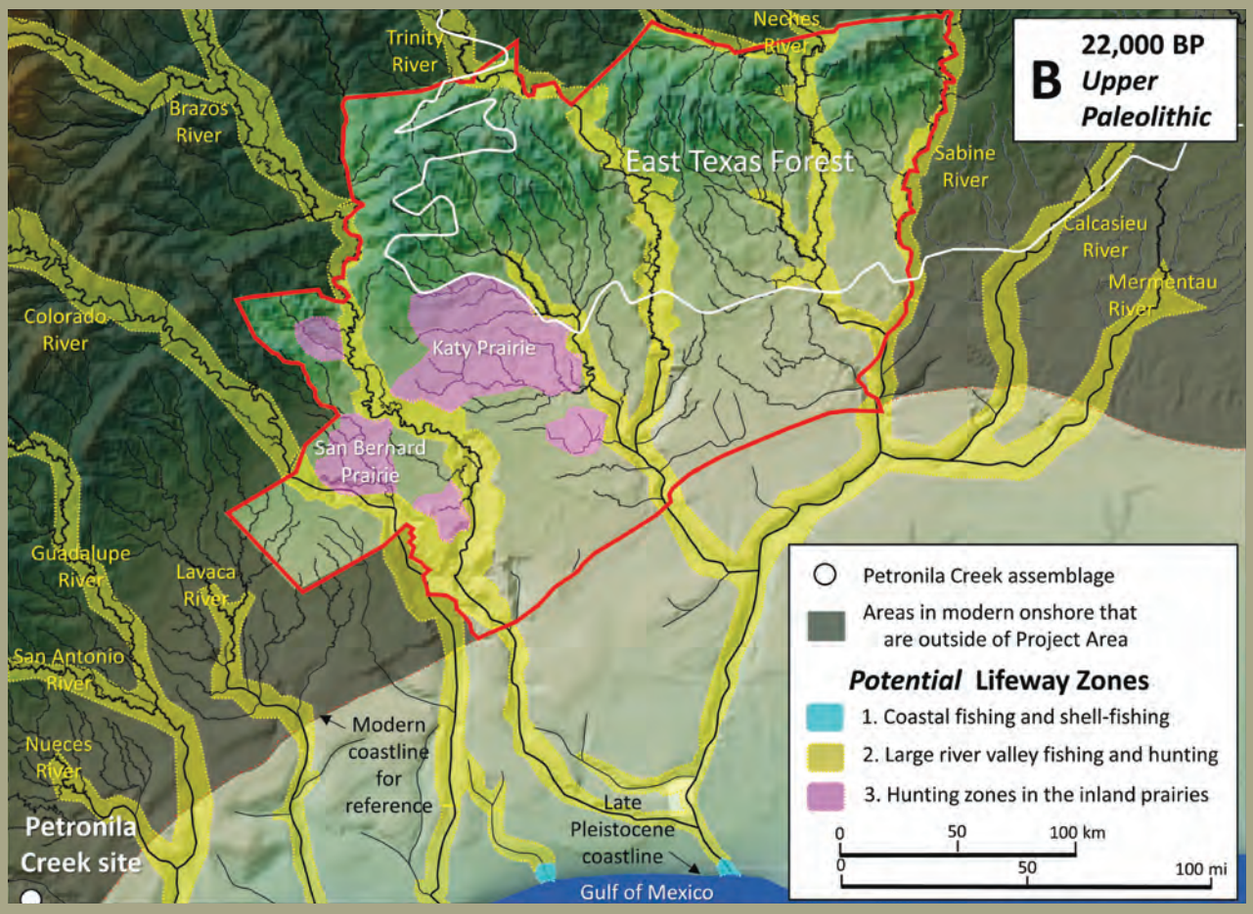


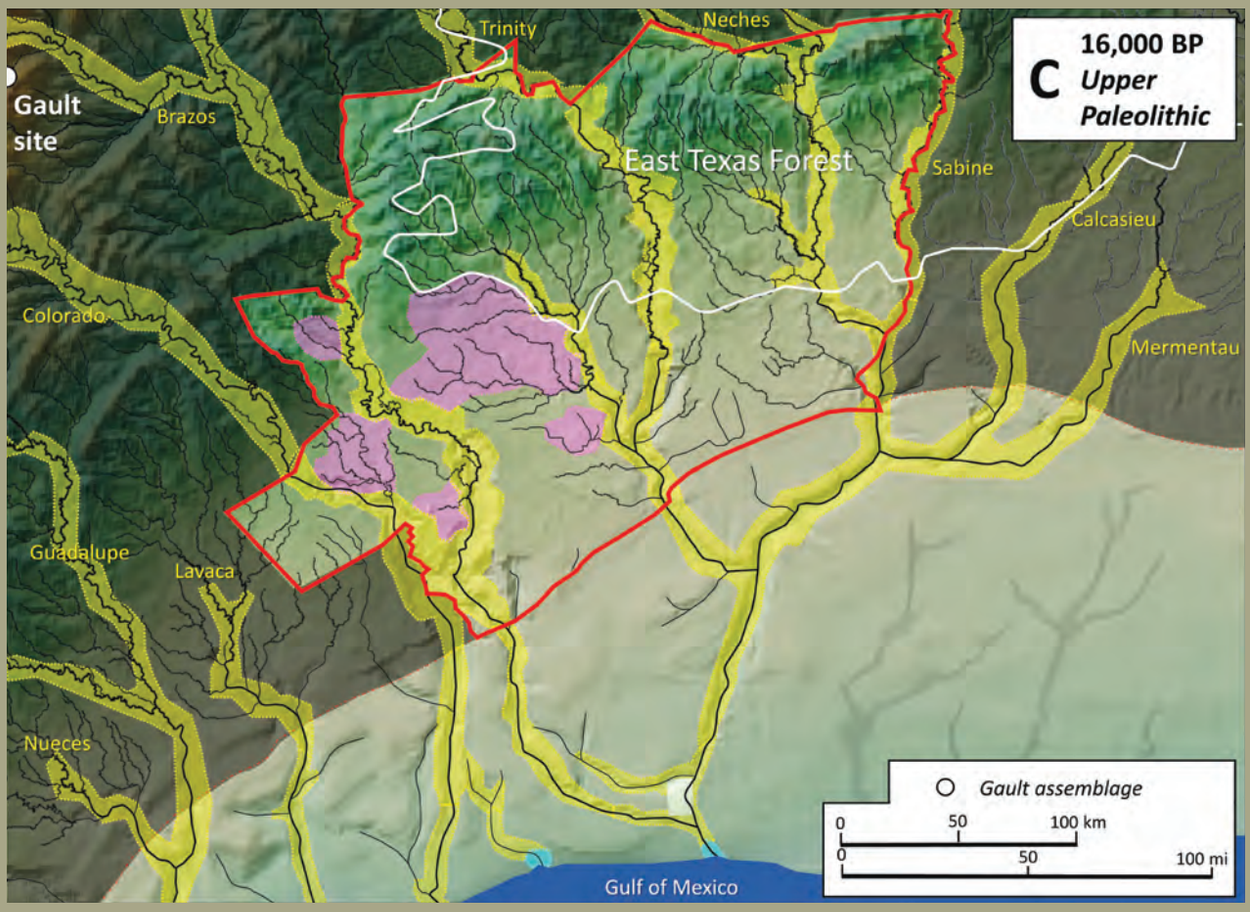

1. Anser Canadensis Auct.
2. Anser intermedius Reaum$^{r}$. – Anser albifrons Auct.
3. Ardea Leuce.  in campis prope Matamoros urbem.

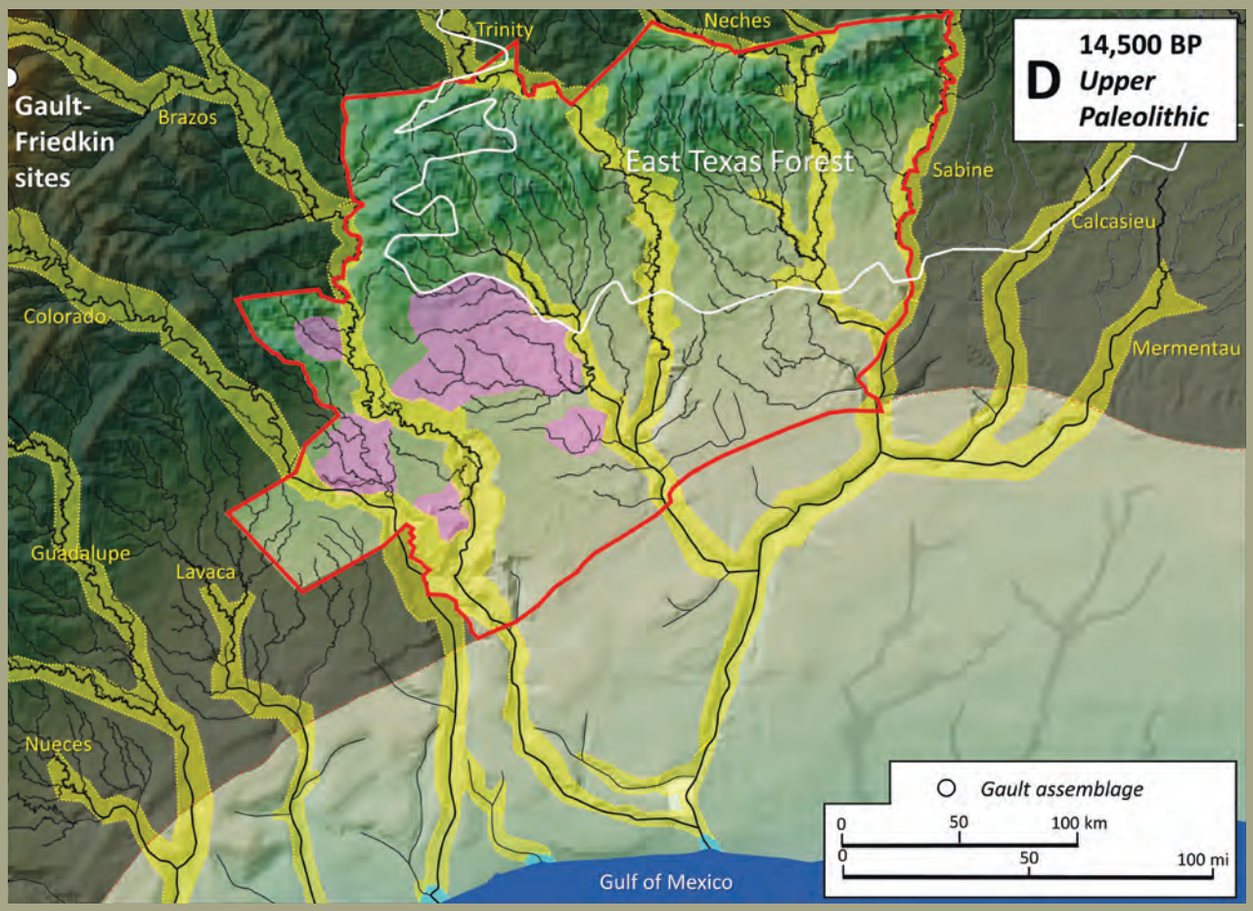
# Atlas IV:

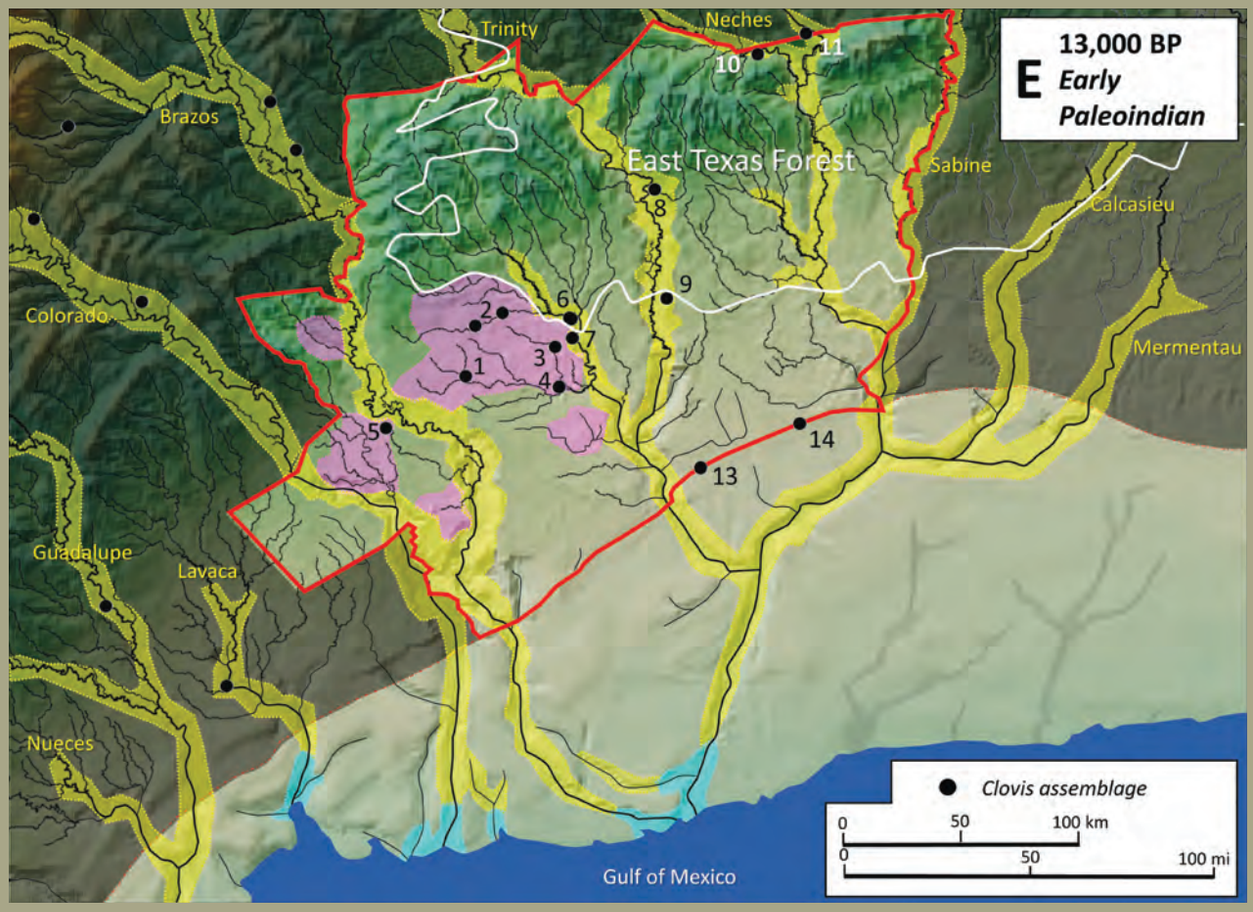
# Paleogeographic reconstructions of Southeast Texas, including archeological sites, 22,000 BP to early Historic Period

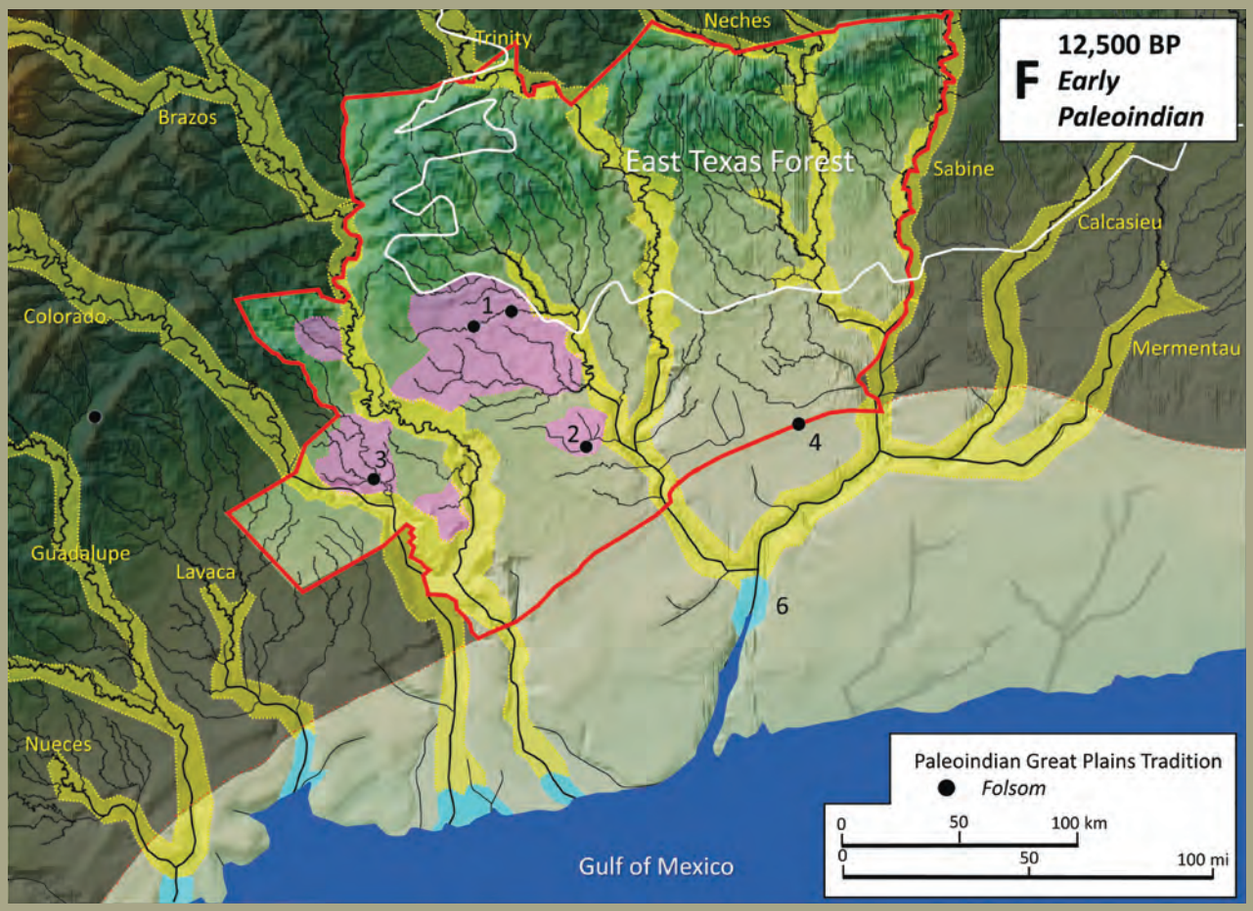


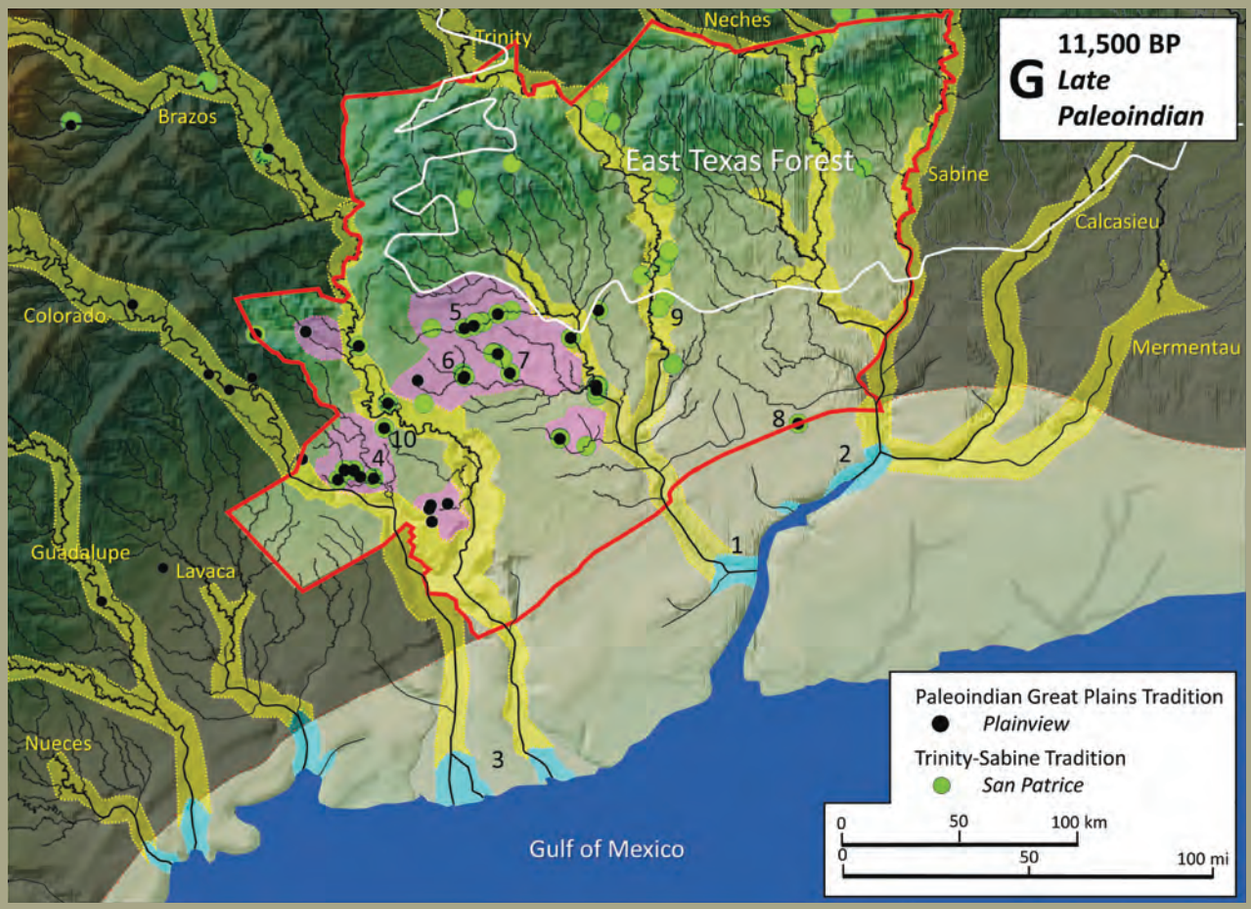

B
22,000 BP
Upper
Paleolithic
Trinity River
Neches River
Brazos River
East Texas Forest
Sabine River
Calcasieu River
Mermentau River
Colorado River
Katy Prairie
San Bernard Prairie
Guadalupe River
Lavaca River
San Antonio River
Nueces River
Modern coastline for reference
Late Pleistocene coastline
Petronila Creek site
Gulf of Mexico
Petronila Creek assemblage
Areas in modern onshore that are outside of Project Area
Potential Lifeway Zones
1. Coastal fishing and shell-fishing
2. Large river valley fishing and hunting
3. Hunting zones in the inland prairies
0 50 100 km
0 50 100 mi

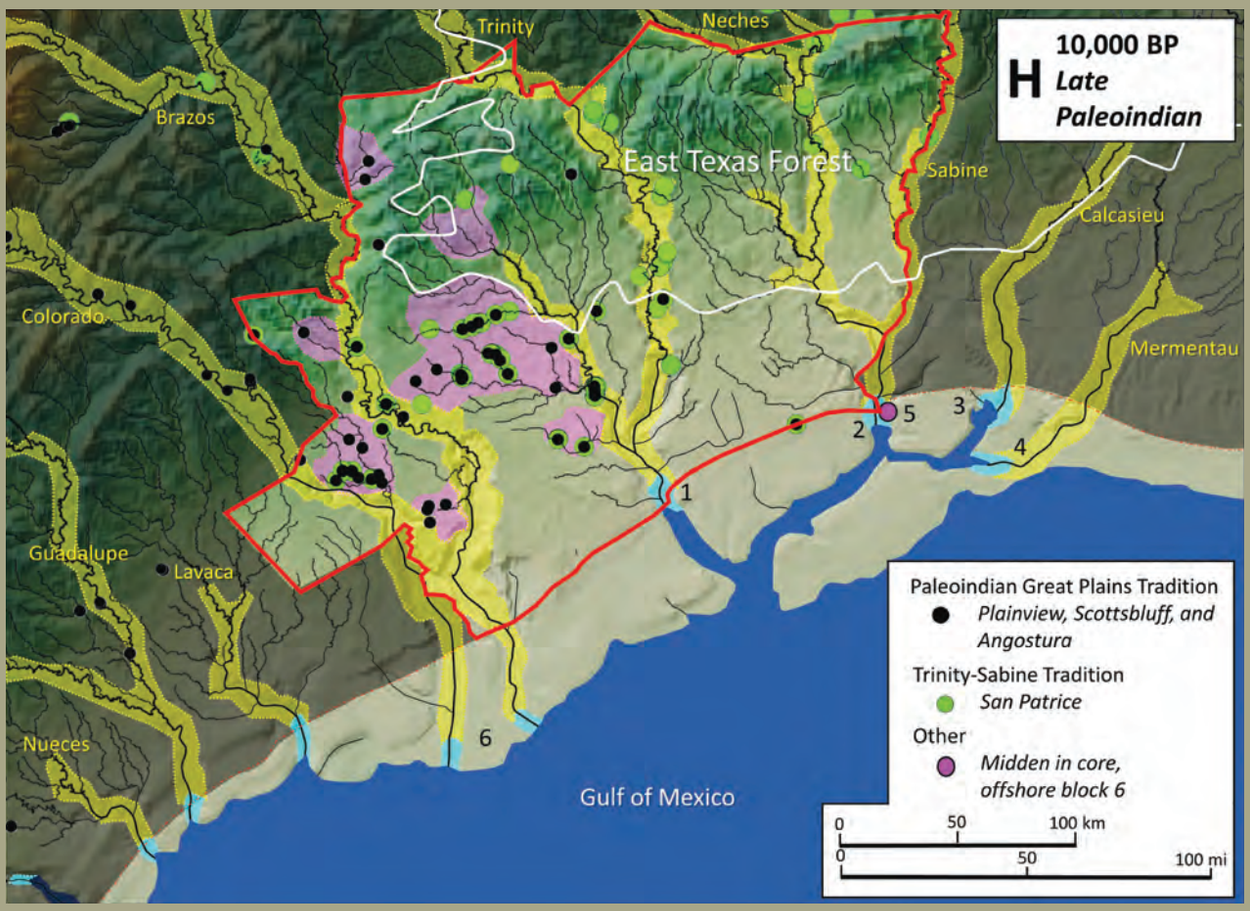

C
16,000 BP
Upper
Paleolithic
Gault site
Trinity
Neches
Brazos
East Texas Forest
Sabine
Calcasieu
Colorado
Mermentau
Guadalupe
Lavaca
Nueces
Gulf of Mexico
Gault assemblage
0 50 100 km
0 50 100 mi

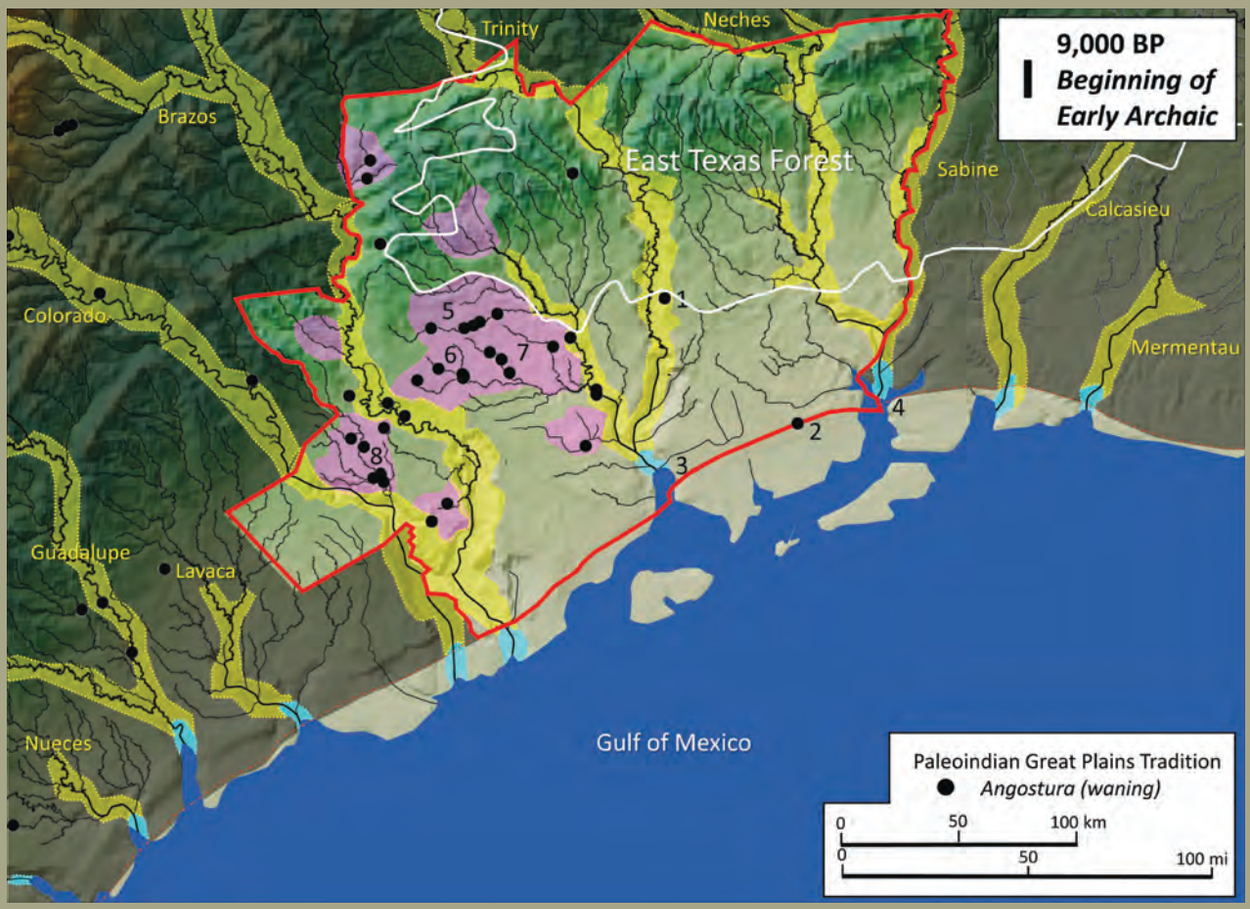

D
14,500 BP
Upper
Paleolithic
Gault-
Friedkin
sites
Trinity
Neches
Brazos
East Texas Forest
Sabine
Calcasieu
Colorado
Mermentau
Guadalupe
Lavaca
Nueces
Gulf of Mexico
Gault assemblage
0
50
100 km
0
50
100 mi

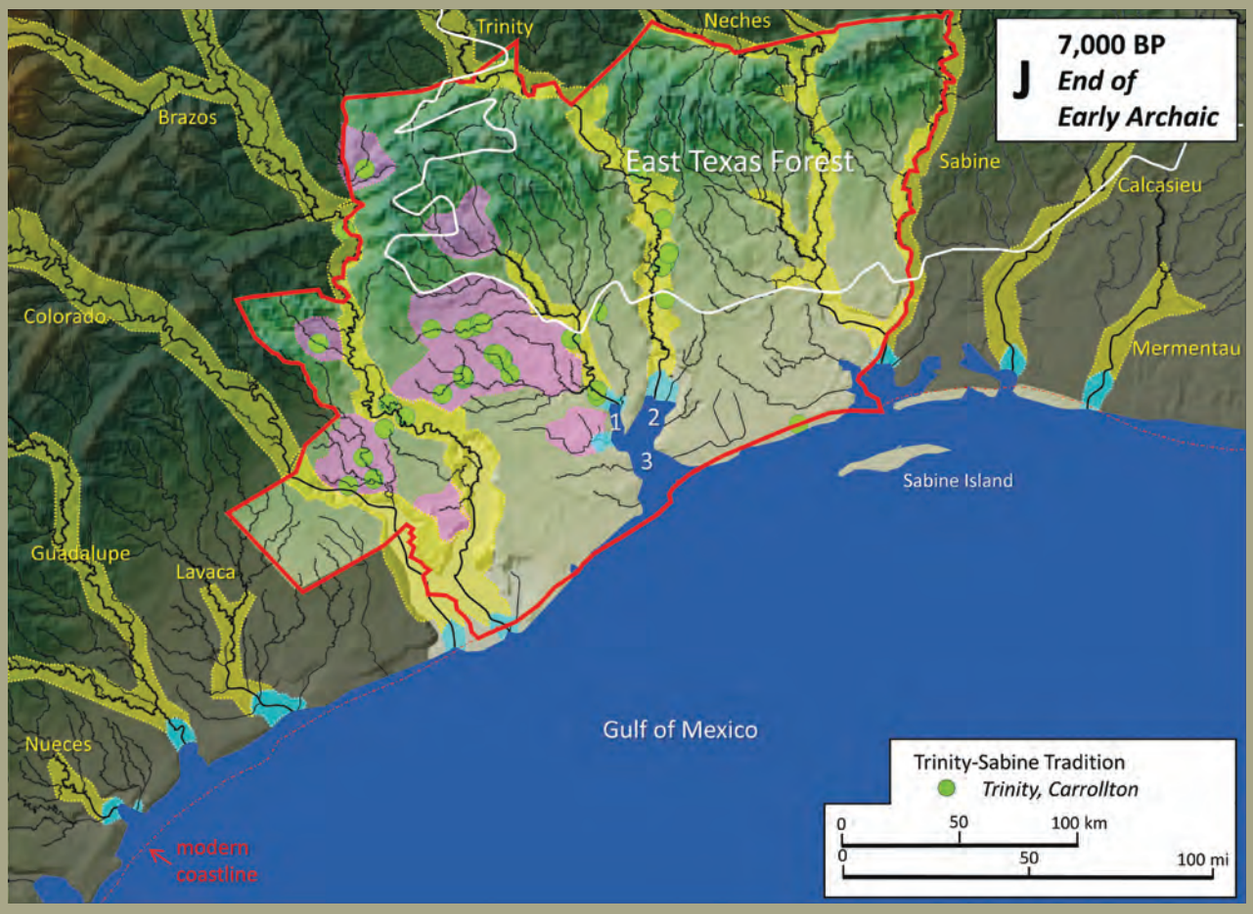

E
13,000 BP
Early
Paleoindian
Trinity
Neches
Brazos
East Texas Forest
Sabine
Calcasieu
Colorado
Mermentau
Guadalupe
Lavaca
Nueces
Gulf of Mexico
1
2
3
4
5
6
7
8
9
10
11
13
14
Clovis assemblage
0
50
100 km
0
50
100 mi

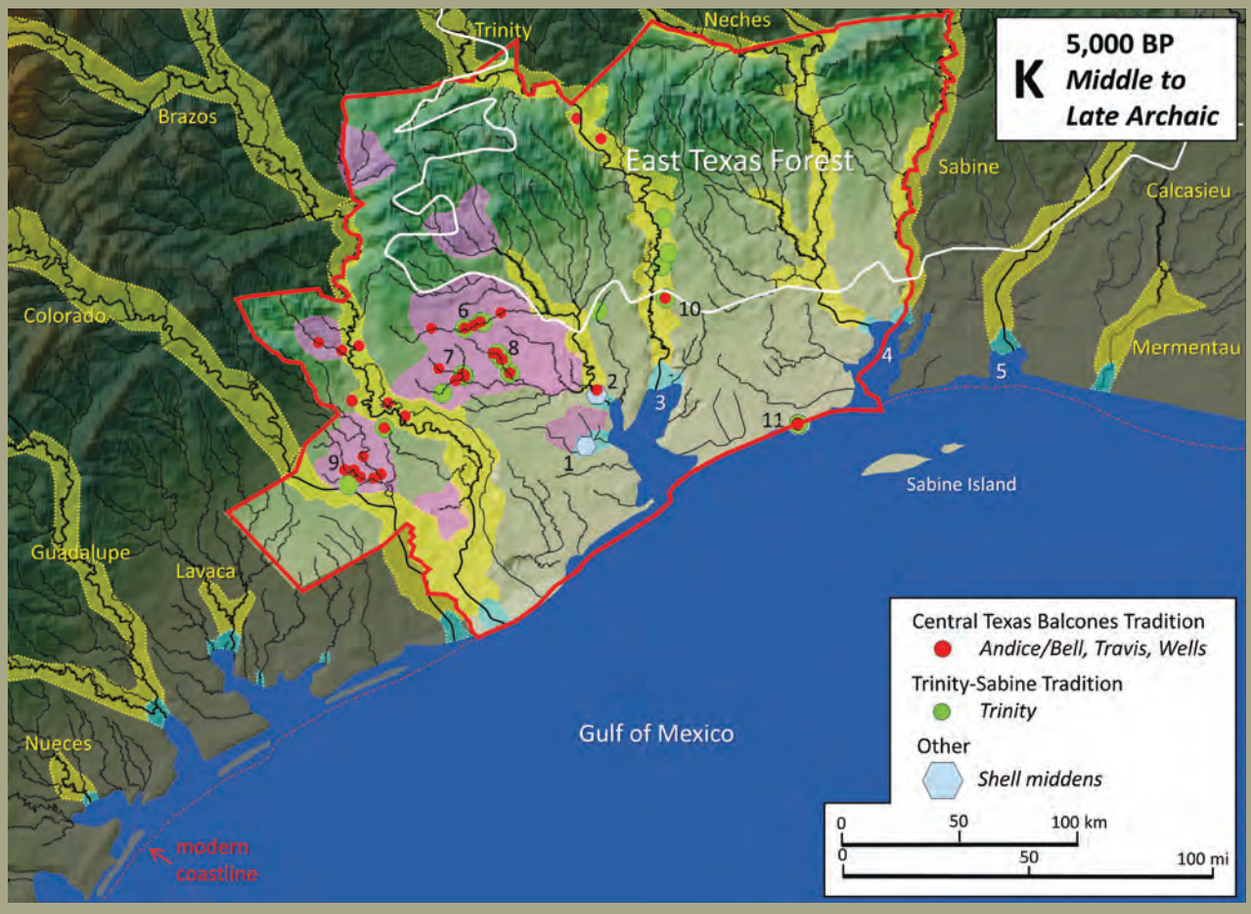

F
12,500 BP
Early
Paleoindian
Trinity
Neches
Brazos
East Texas Forest
Sabine
Calcasieu
Colorado
Mermentau
Guadalupe
Lavaca
Nueces
Gulf of Mexico
1
2
3
4
6
Paleoindian Great Plains Tradition
Folsom
0
50
100 km
0
50
100 mi

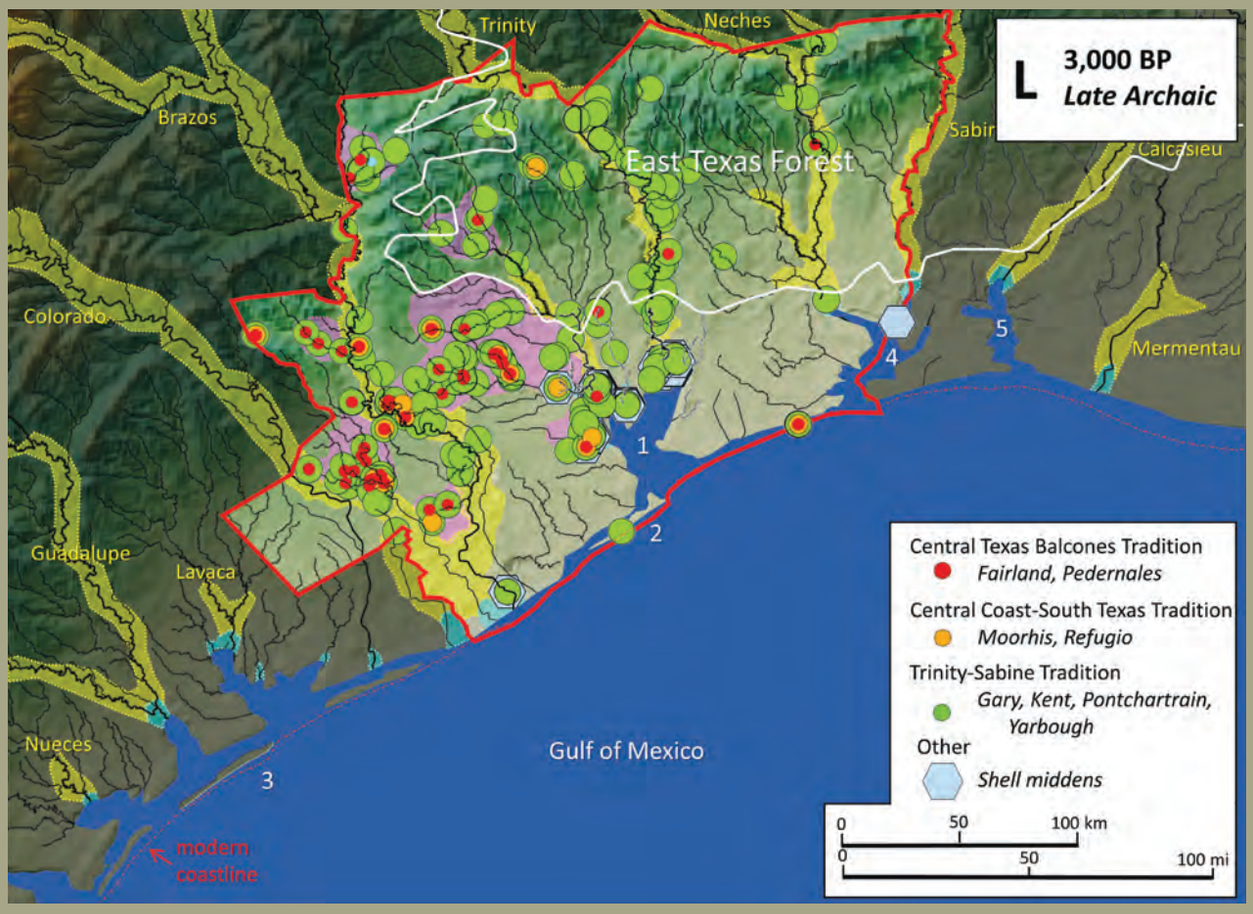

G
11,500 BP
Late
Paleoindian
Trinity
Neches
Brazos
East Texas Forest
Sabine
Calcasieu
Colorado
Mermentau
Guadalupe
Lavaca
Nueces
Gulf of Mexico
1
2
3
4
5
6
7
8
9
10
Paleoindian Great Plains Tradition
Plainview
Trinity-Sabine Tradition
San Patrice
0
50
100 km
0
50
100 mi

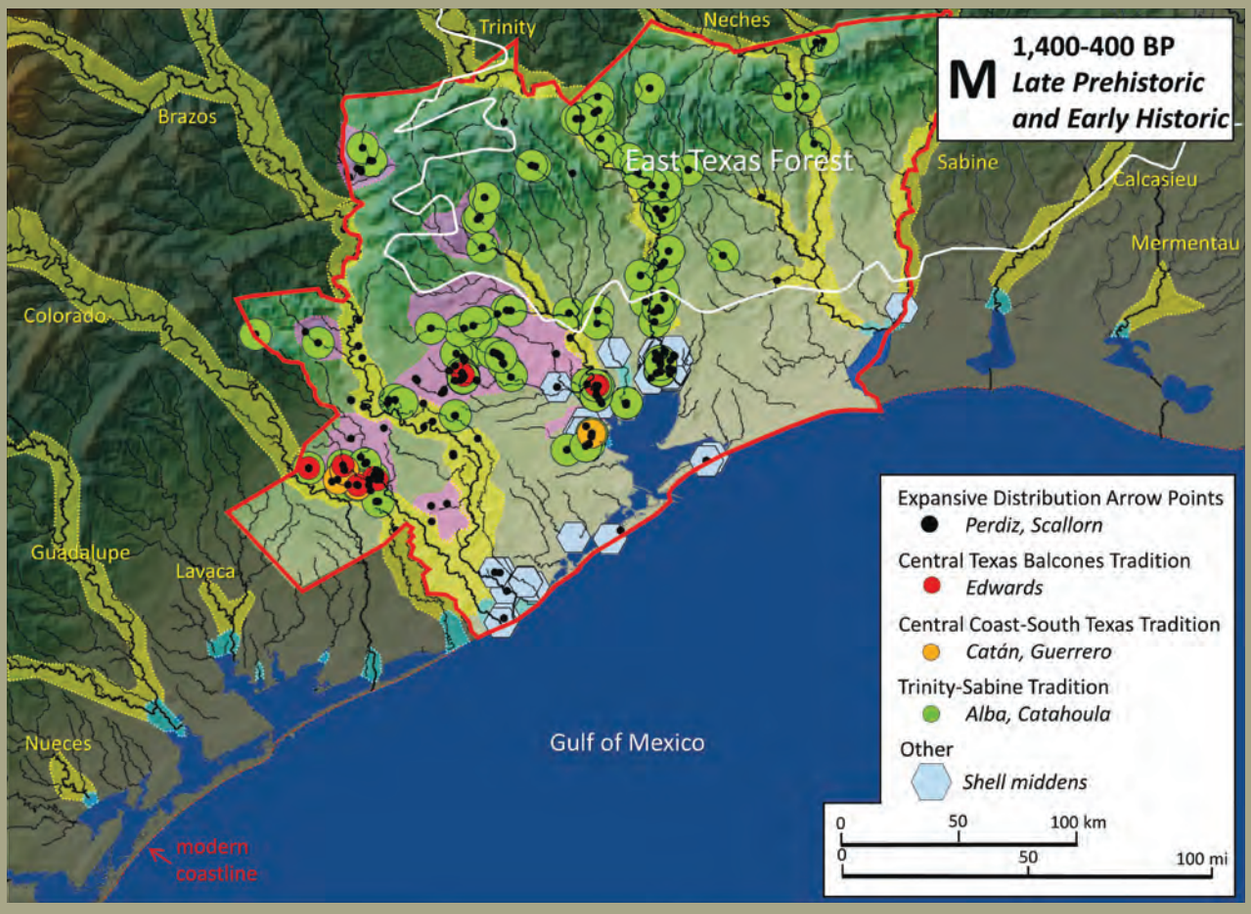

H
10,000 BP
Late
Paleoindian
Trinity
Neches
Brazos
East Texas Forest
Sabine
Calcasieu
Colorado
Mermentau
Guadalupe
Lavaca
Nueces
Gulf of Mexico
1
2
3
4
5
6
Paleoindian Great Plains Tradition
Plainview, Scottsbluff, and Angostura
Trinity-Sabine Tradition
San Patrice
Other
Midden in core, offshore block 6
0
50
100 km
0
50
100 mi

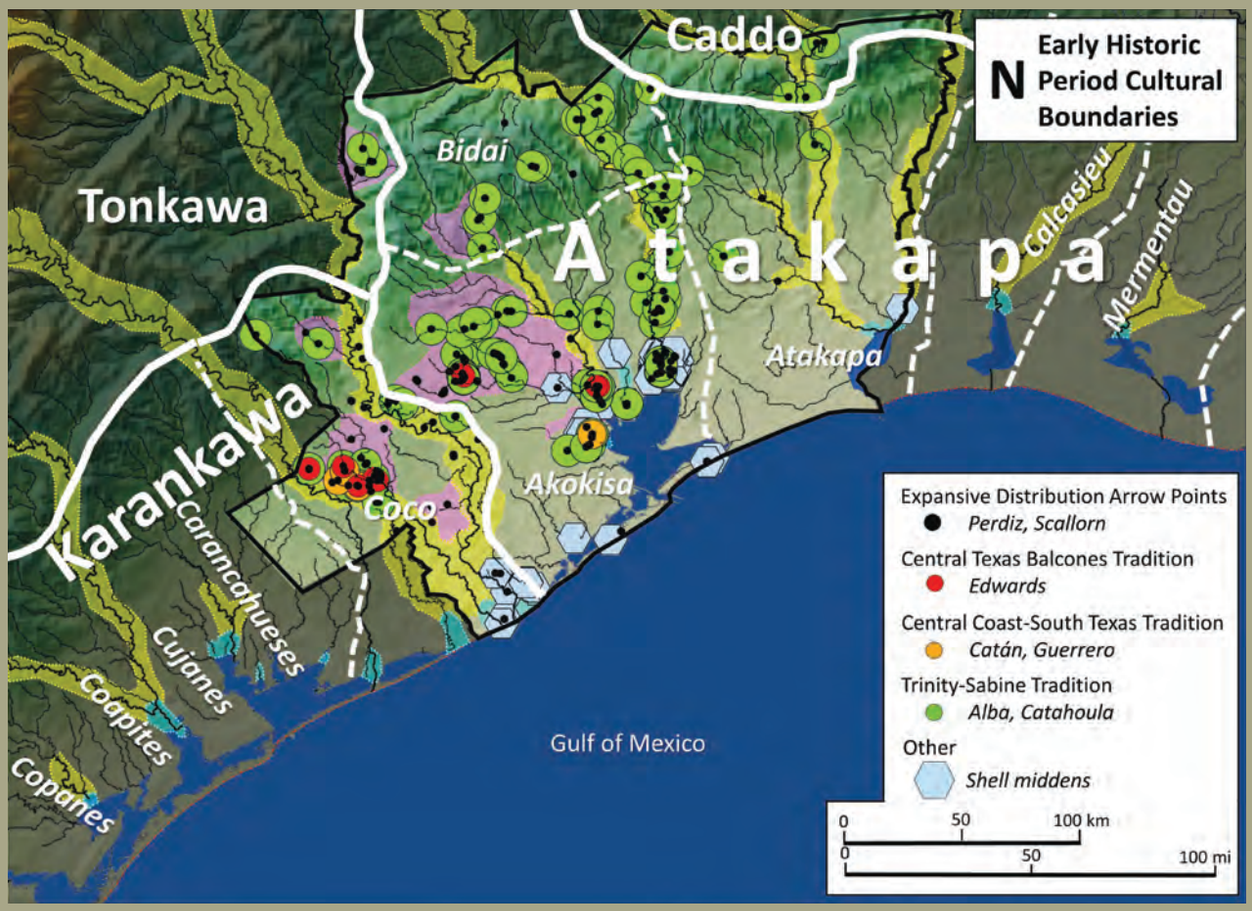

I
9,000 BP
Beginning of
Early Archaic
Trinity
Neches
Brazos
East Texas Forest
Sabine
Calcasieu
Colorado
Mermentau
Guadalupe
Lavaca
Nueces
Gulf of Mexico
1
2
3
4
5
6
7
8
Paleoindian Great Plains Tradition
Angostura (waning)
0
50
100 km
0
50
100 mi

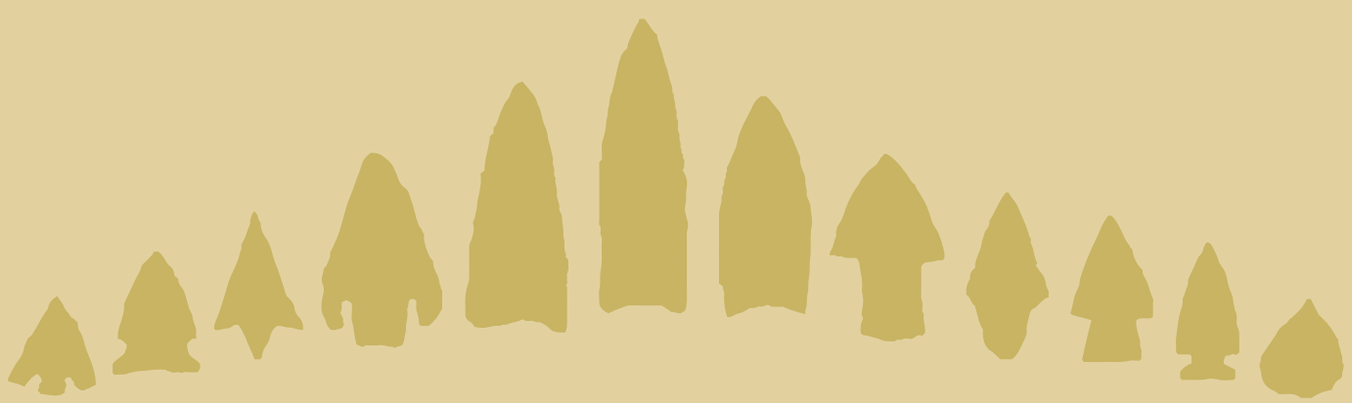

J
7,000 BP
End of
Early Archaic
Trinity
Neches
Brazos
East Texas Forest
Sabine
Calcasieu
Colorado
Mermentau
1
2
3
Sabine Island
Guadalupe
Lavaca
Gulf of Mexico
Nueces
modern
coastline
Trinity-Sabine Tradition
Trinity, Carrollton
0
50
100 km
0
50
100 mi


K
5,000 BP
Middle to
Late Archaic
Trinity
Neches
Brazos
East Texas Forest
Sabine
Calcasieu
Colorado
6
7
8
10
4
5
Mermentau
2
3
11
1
9
Sabine Island
Guadalupe
Lavaca
Gulf of Mexico
Nueces
modern
coastline
Central Texas Balcones Tradition
Andice/Bell, Travis, Wells
Trinity-Sabine Tradition
Trinity
Other
Shell middens
0
50
100 km
0
50
100 mi


L
3,000 BP
Late Archaic
Trinity
Neches
Brazos
East Texas Forest
Sabine
Calcasieu
Colorado
Mermentau
Guadalupe
Lavaca
Nueces
Gulf of Mexico
modern coastline
1
2
3
4
5
Central Texas Balcones Tradition
Fairland, Pedernales
Central Coast-South Texas Tradition
Moorhis, Refugio
Trinity-Sabine Tradition
Gary, Kent, Pontchartrain, Yarbough
Other
Shell middens
0
50
100 km
0
50
100 mi


M
1,400-400 BP
Late Prehistoric and Early Historic
Trinity
Neches
Brazos
East Texas Forest
Sabine
Calcasieu
Mermentau
Colorado
Guadalupe
Lavaca
Nueces
Gulf of Mexico
modern coastline
Expansive Distribution Arrow Points
Perdiz, Scallorn
Central Texas Balcones Tradition
Edwards
Central Coast-South Texas Tradition
Catán, Guerrero
Trinity-Sabine Tradition
Alba, Catahoula
Other
Shell middens
0
50
100 km
0
50
100 mi


Caddo
Early Historic Period Cultural Boundaries
N
Bidai
Tonkawa
A t a k a p a
Calcasieu
Mermentau
Atakapa
Karankawa
Akokisa
Coco
Carancahueses
Cujanes
Coapites
Copanes
Gulf of Mexico
Expansive Distribution Arrow Points
Perdiz, Scallorn
Central Texas Balcones Tradition
Edwards
Central Coast-South Texas Tradition
Catán, Guerrero
Trinity-Sabine Tradition
Alba, Catahoula
Other
Shell middens
0
50
100 km
0
50
100 mi



# 11.

# Regional trade, ceramic technology, and a new age: the Late Archaic and Woodland periods

During the Late Archaic, Early Ceramic, and Late Prehistoric periods, a time of rapid technological and cultural change came to a Southeast Texas region that had seen little significant change from a relatively simple hunter-gatherer lifestyle for thousands of years. Artifacts from Southeast Texas sites show a remarkably and aburptly increased regional exchange of goods with distant regions beginning in the Late Archaic Period, followed by the adoption of ceramic technology and the use of the bow and arrow. At the same time, population in Southeast Texas increased dramatically, as evidenced by numbers of sites (Chapter 5). To understand the origins of this rapid change, it is necessary to widen the aperture of our field of study, and to consider the pace and nature of change of other cultures in surrounding regions, in particular the Woodland cultures of the Ohio and Mississippi river valleys of eastern North America.

As mentioned in Chapter 5, the term "Woodland Period" has not typically been applied to Southeast Texas chronology, where the time chart—with the exception of the added term Early Ceramic Period—mirrors that of Central Texas (Figure 11.1, column A vs. column G). The term was introduced in the 1930s to describe a period of time in the eastern United States that is intermediate between that of Archaic hunter-gatherers who preceded the Woodland Period, and that of the clearly agricultural Mississippian cultures who followed it. The Woodland Period was a time of gradual development of a more sedentary cultural lifestyle, which included

the construction of massive burial and ceremonial mounds in the Mississippi and Ohio river valleys. While Southeast Texas never developed the massive ceremonial centers of classic Woodland cultures, nor did its early Historic Period Atakapa and Coco-Karankawa cultures adopt agriculture, but they did share in other Woodland era technological developments like the adoption of ceramics. Moreover, they were participants in the large, long distance exchange networks of goods and ideas that characterized many cultures of both the Late Archaic and Woodland periods in eastern North America. The activities of people in Southeast Texas were thus somewhat intertwined with those of eastern Woodland cultures, and these people could be considered as living in the Woodland culture's southwestern frontier.

The great engine that propelled cultural change and technology development was located in the heartland of the eastern U.S., in the Mississippi and Ohio river valleys plus an adjacent part of the eastern Great Lakes region (Atlas V, Frame 1). Here three material cultures developed in quick succession that became centers for regional exchange of goods: the Glacial Kames culture, from about 1030 BC to 370 BC (Donaldson and Wortner 1995), the Adena culture from 800 BC to AD 1, and the Ohio Hopewell culture from 100 BC to AD 500 (Ohio History Central 2020). Recent mitochondrial DNA studies demonstrate affinity among the Glacial Kames people with later Adena people and still later Hopewell people, confirming a general impression long held among archeologists and anthropologists that the three were part of a continuum of social development (Mills 2003; Lepper 2006; Keller, 2009).

In this chapter the significant cultural and technological changes that swept through Southeast Texas beginning in Late Archaic time and culminating during the Woodland Period are described, along with the migration of Woodland influ-

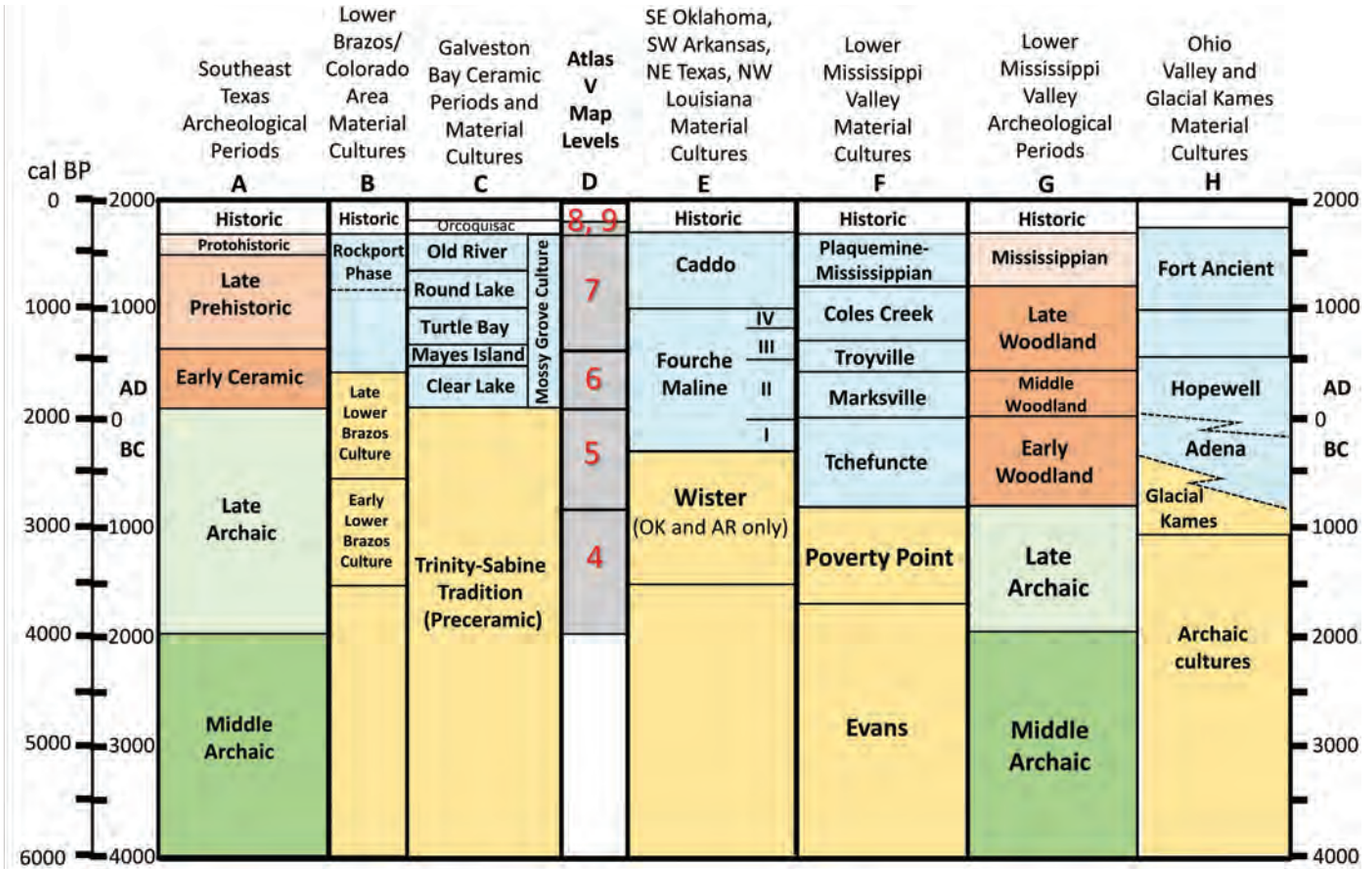



Figure 11.1. Regional chronology for Southeast Texas and the Lower Mississippi Valley compared, 4000 BC to present, showing archeological periods for the two regions (columns A and G) and their respective temporal limits (columns B, C, E, F and H). Sources: Southeast Texas (Patterson 1996), Galveston Bay (Aten 1983; Story 1990), Oklahoma-Arkansas (Leith 2014; Galm n.d.), Louisiana (Rees 2010), Ohio Valley (Donaldson and Wortner 1995, Glacial Kames; Ohio History Central 2020, Adena, Hopewell); Lower Brazos area (this report).

In the cultural columns, tan shading represents pre-ceramic cultures, and light blue, cultures with ceramics. Red numerals in column D depict time intervals of the maps in Atlas V.

ences (especially the spread of ceramics) to the material cultures of Southeast Texas and its surrounding region. Figure 11.1 displays chronologies for material cultures in the Southeast Texas areas of Galveston Bay (column C) and the Brazos-Colorado region (column B); for the Fourche Maline and, later, Caddoan material cultures of southeast Oklahoma, southwest Arkansas, northeast Texas and northwest Louisiana (column E); and for material cultures of the Lower Mississippi Valley (column F) and the Ohio Valley and eastern Great Lakes (column H). "Material culture" means the artifacts of a particular area and time, which can be discussed without necessarily implying the lineal ancestry of all of the people who took part in that material culture. For example, a far future archeologist might define a "Smart Phone material culture" for a widespread occurrence of iPhone artifacts in European archeological sites of the twenty-first century. It would obviously be wrong to infer that iPhone users were members of any particular ethnic or linguistic group, as iPhone users in today's Europe are members of many ethnic and linguistic groups.

In this chapter, we mostly use calendric "years BC or AD" terminology rather than "years BP (Before Present)"; such is the general practice for events in relatively recent times. Both systems are shown on the left in the chronologic chart of Figure 11.1.

## Middle Archaic Precursors, 4000–2000 BC

By the Middle Archaic Period, regional exchange networks were active in various parts of eastern North America. At Indian Knoll in west-central Kentucky, on the Green River 60 km southeast of its confluence with the Ohio River (location 17, Atlas V, Frame 1), a very large freshwater shell mound containing over 1.000 burials excavated in the 1940s yielded abundant marine shell ornaments (Webb 1946). Over 4,000 pieces of *Busycon* sp., a warm water whelk found from the northwest Mexico Gulf Coast to the Carolinas, were excavated, some as whole shell or nearly whole cups (made by removing the central columella of the gastropod), others cut into pear-shaped pendants, round gorgets, and small beads.

The shells used in this site are the familiar lightning whelk of the Gulf Coast, called *Busycon contrarium* by Hall (1981) but more commonly called *Busycon perversum*, a synonym (Dreiss 2001; Keller 2009). It is also sometimes called *Busycon sinistrum* (Marquardt and Kozuch 2016). All these synonyms refer to the fact that this gastropod spirals in a sinistral fashion (left-handed or counter-clockwise; see Figure 11.2, top view), unlike all other *Busycon* whelks, which spiral in a right-handed fashion. Clearly valued in prehistory, it may have been regarded as sacred by Native Americans because of that unusual factor (Wintemberg 1908; Marquardt and Kozuch 2016). *Busycon perversum/contrarium* is found along the entire northern Gulf Coast from northeastern Mexico to western Florida as well as along the Atlantic coast of Florida and Georgia (Global Biodiversity Information Facility n.d.). Their current range is shown on the map of Atlas V, Frame 1.

Abundant Gulf Coast *Busycon* shells present at Indian Knoll and other Middle Archaic Ohio Valley sites were among the earliest of what would become a Late Archaic regional phenomenon of importing marine *Busycon* shells to this inland region. Other imported marine shells included lesser numbers of small marine

Figure 11.2. *Busycon contrarium*, the lightning whelk. This is a fossil specimen from the Pliocene of Florida. Note the sinistral, counter-clockwise spiraling in the top view, a signal characteristic of this species. Photograph courtesy of H. Zell, Wikimedia Com-mons.

*Olivella* and *Marginella* shells, and the burials also included small amounts of copper beads and pendants; the copper was probably imported from the Lake Superior region (Claassen 1996; see Atlas V, Frame 1). The burials have been radiocarbon dated at 5590 to 4530 cal. BP (3640 BC–2580 BC), in the middle of Middle Archaic time (Morey et al. 2002). By 4000 BC archeological sites in inland areas also included exotic steatite (soapstone), chert, and banded slate obtained from various places, indicating movement of goods (Webb 1946; Milner 2004). The uneven distribution of exotic shell, stone, and copper artifacts accompanying burials indicates some degree of social status within otherwise small groups of hunter-gatherer people. Grave goods were found with men, women, and children.

At more or less the same time as the Indian Knoll mound in Kentucky, groups of Middle to Late Archaic mound builders sprang up at various points in the Lower Mississippi Valley (LMV) as well as other major drainages of the Midsouth and lower Midwest, including the Ohio River (Anderson and Sassaman 2007). Thirteen earthen mound sites in the Lower Mississippi Valley have been found that date from 3700 BC to 2800 BC in age, the most impressive and best-dated being Watson Brake in northern Louisiana (location 18, Atlas V, Frame 1; Saunders 2010). Their residents—like their contemporaries in Southeast Texas—were riverine hunter-gatherers who lived on a diet of fish and deer and gathered nuts and berries, showing that agriculture was not a necessary precondition for the organization of a mound-building social order. They were, however, more sedentary than the widely ranging foragers of East and Southeast Texas and other outlying regions outside of the Ohio-Mississippi drainage basin (Anderson and Sassaman 2007). For an unknown reason, mound building at Watson Brake and other such Middle Archaic LMV centers ceased around 2800 BC, not to resume for over a thousand years (Saunders 2010).

Southeast Texas at this time was a cultural backwater relative to the rapidly developing mound cultures to the east, but the effects of Eastern Woodland cul-

ture are evident in multiple Late Archaic sites of the region. In the descriptions that follow, the focus is on cultural regions of the Lower Mississippi Valley; the Ouachita region of Oklahoma and Arkansas as well as its cultural extension into northeast Texas and northwest Louisiana; the Central Texas region; and Southeast Texas-southeastern Louisiana.

## Early Late Archaic Period, 2000 BC–800 BC

### Lower Mississippi Valley and Poverty Point

The resumption of mound building in the LMV that had ceased following Watson Brake began with the emergence of Poverty Point material culture in 1700 BC, during the earlier part of the Southeast Texas Late Archaic (Gibson 2010; Figure 11.1, column F). This culture was marked by "ceremonial organization, massive mound construction, village planning, ceramics, figurines, advanced lapidary industry, and probable agriculture" (Webb 1968). The Poverty Point mound site, the most impressive of many such sites of this time, is located in extreme northeastern Louisiana, on a ridge overlooking the Mississippi River Valley (Atlas V, Frame 4, location 7). This large site contained the largest assemblage of mounds in North America in Archaic time, arranged in semi-circular rows (Figure 11.3); the ridge-shaped mounds are thought to have been capped with small habitations (Gibson 2010).

Like their Southeast Texas contemporaries, Poverty Point people were hunter-gatherers who excelled in harvesting food resources from a wetland floodplain terrain: fish, turtles, aquatic roots, and the like. Of the lithic projectile points found there, the most common are Gary points made of local materials, not unlike those used by contemporaries in Southeast Texas at that time. The economy of Poverty Point, however, seems to have been based on a large lapidary industry, and lithic tools are common at the site. Exotic rocks used in items like ground stone ornaments and atlatl weights make up significant parts of site assemblages in all Poverty Point era sites, including items made from the nepheline syenite of the eastern Ouachita Mountains, worked non-local sandstone, quartz crystals from the Ouachitas, galena from the Ozarks and the Upper Mississippi, and copper, thought to come from the Great Lakes. Items less linked to specific places include magnetite, schist, phyllite, flint, and a host of other materials. As Gibson summarizes, much of the stone was worked on site before being shipped, and there was too much of it to account for any other shipping method than that by boats coming down the rivers.

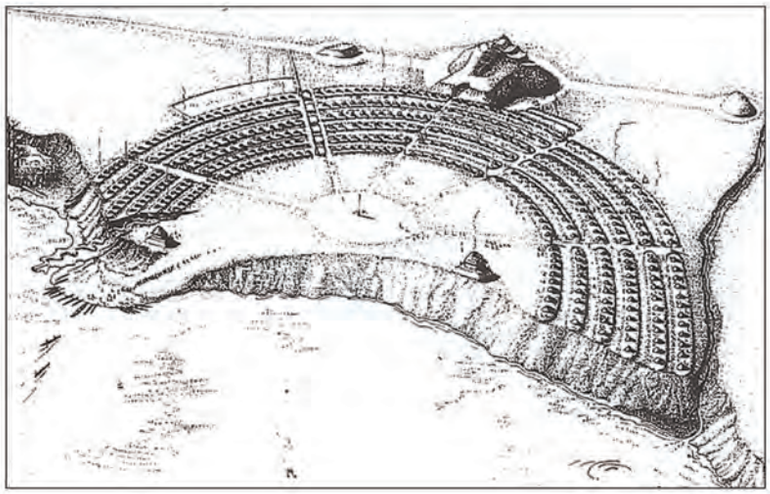


Figure 11.3. Bird's-eye view of the earthworks at the Late Archaic Poverty Point site, northeastern Louisiana, as it may have appeared in 1350 BC. Six concentric earth-en ridges surround a central plaza, and each appears to have each been capped by individual dwelling places. The large earthen mound on the outer perimeter is thought by some to have been built in the shape of a bird; it is the second largest mound in North America. Drawing courtesy of Jon Gibson.

One such site associated with the Poverty Point era lapidary industry is the Slate site, on a meander of the Mississippi River (Frame 4, location 15). The people who lived at this site focused on a lapidary industry using slate, quartz crystals, quartz, bauxite, quartz diorite, and jasper. They produced beads of various shapes, effigies, and other items. Found at the site were

boatstones, gorgets, pendants, and plummets all made of stone during what appears to have been a late stage Poverty Point occupation (Lauro and Lehmann 1982). Its river location is a clear indicator that supplies for their industry were transported for long distances by boat, and boats perhaps also accounted for the transport of their products to market.

Poverty Point was well located as a receiving place for exotic rocks and copper; as Gibson (1990) noted, "Poverty Point was probably established where it was because of its location at the first point of high ground below the confluence of all the trade routes [north] and the Mississippi River." There are, however, essentially no marine shell objects, such as *Busycon* pendants or gorgets. It is possible that the acid loess soil at Poverty Point has erased all evidence of shell and bone material (Webb 1968). The absence of *Busycon* debris is puzzling, especially because there is not much in the way of *Busycon* ornaments (pendants and gorgets) in later Tchefuncte sites of the same general LMV region (e.g., Ford and Quimby 1945); more on this later.

**Ceramics arrive**. It was at about this same time that ceramic technology came to the Gulf Coast region. St. John's ware, containing microscopic marine sponge spicules that place its fabrication in coastal sites, originated along the Atlantic coast of Florida, along the St. John's River (Russo and Heide 2004). Fragments of St. John's pottery were found at the Poverty Point and Claiborne sites (Atlas V, Frame 4, locations 7 and 8) that appear to have been imported at some time between 1470 BC and 1385 BC; these are the earliest known ceramics in the region (Hays and Weinstein 2004). It would seem sensible that the St. John's ceramic pieces first entered the LMV at the Claiborne site, and then moved up to the very considerable settlement at Poverty Point. It is likely that the pieces were carefully examined as something new and useful, and before long the first Tchefuncte ceramic pieces were being made in the valley. Early Tchefuncte pieces have been dated at 1450 BC to 850 BC at the Jaketown, Poverty Point, Cross Bayou, and Bayou Jasmine sites (Jenkins et al. 1986; Hays and Weinstein 2004), and other less well dated samples were found at Teac Creek, Ruth Canal, and the Meche-Wilkes sites, all in the LMV (see Frame 4); it is thought that Tchefuncte production started at one or more of these sites (Gibson and Melancon 2004). In the Eastern U.S. the arrival of ceramics is typically considered one of the keystone events signaling the beginning of the Woodland Period, but in the LMV these items arrived considerably sooner, during the Late Archaic (Saunders and Hays 2004). The later rise of Tchefuncte ware as the first widely used ceramic indeed came in the Early Woodland period, discussed in the next section.

A significant cultural achievement by any definition, the early Late Archaic Poverty Point site was abandoned by about 1100 BC (Gibson 2000; Kidder 2001). A migration and subsequent re-organization of the course of the Mississippi River, along with related flooding, seems to have been the cause (Kidder et al. 2017).

### Wister Phase, Oklahoma-Arkansas

The Late Archaic Wister Phase of southeastern Oklahoma and southwestern Arkansas (1500 BC–300 BC) was introduced as an archeological construct by Bell

(1980) and expanded by Galm (1984, n.d.). It is centered on the Wister Valley in Le Flore County (Atlas V, Frame 4, location 1), within the Ouachita Mountains. Evidence for this phase is found in a number of small middens with lithic projectile points, ground stone artifacts, bone tools, and marine shell ornaments, indicative of hunter-gatherer base camps. The phase ends with the introduction of ceramics at the beginning of the Woodland Period Fourche Maline Phase (discussed later). People of the Wister phase are interpreted to have been hunter-gatherers, located in seasonal base camps; there is no evidence of agriculture (Rowe 2014).

The beginning of the Wister phase is marked by an increased number of artifacts made of bone, shell, and ground stone. The shell ornaments are of marine origin, an indicator that long-distance exchange had begun with groups along the Gulf Coast. At the Bug Hill site (Atlas V, Frame 4, location 2), imported marine shell ornaments in Wister phase debris took the form of pendants and beads, and there was a rolled copper tube, likely from Lake Superior. There were also decorated and undecorated bone artifacts (Vehik 1982:405–406).

Other Wister sites include ground stone boatstones (more on cup-shaped boatstones later, but these are among the earliest known examples) and ground stone pendants (Galm 1984, n.d.). On the periphery of the range of the Wister Phase, near the core of the Ouachita Mountains, are four stocks of mafic and intermediate igneous rocks that include nepheline syenite, a very unusual rock type that occurs only there in eastern North America (Frame 4, location 6). That rock type occurs in artifacts at Poverty Point, raising the question of whether Poverty Point people ventured there to mine it, or whether people of the Wister Phase mined it and exchanged it with their Poverty Point contemporaries. Other Ouachita and Ozark Rim lithologies found at Poverty Point include hematite, novaculite, magnetite, quartz crystal, greenstone, slate, bauxite, and shale (Gibson 2010; Wyckoff 1980, 1984). Such trade in exotic rocks from the Ouachitas and marine shell for ornaments from the Gulf Coast was a precursor of much more to come during the Woodland Period.

The Wister phase seems geographically constrained in the Wister Valley, which Schambach (1998) has described as "a long tongue of the Eastern Woodlands on the 'wrong' side of the Mississippi River . . . in semi-isolation west of the Lower Mississippi Valley." Its isolation can be seen in sites to the south like the Bell site (Frame 4, location 3) that are clearly unrelated to the Wister Phase. The Bell site is a long-lasting multicomponent site stretching from Late Paleoindian through Caddoan periods (Wyckoff 1968; Story 1990). It has typical Late Archaic projectile points of the region, including Lange, Marcos, Palmillas, and Williams. It records a more intensive use of the site than earlier in pre-Late Archaic time, but neither this site nor immediately surrounding sites show evidence of the artifact-rich middens associated with the Wister phase to the north, suggesting only marginal use of the site by hunter-gatherers at this time (Story 1990:225). Marcos points, for example, belong to a central Texas-based point style (see Atlas II), suggesting that the site was a Great Plains hunting site used by roaming hunters, rather than a site showing the beginnings of a more sedentary culture.

## The Trinity-Sabine Tradition and Southeast Texas

Still farther south from the Wister Phase sites, time-correlative early Late Archaic sites at Jake Martin (Frame 4, location 4) and Yarbrough (location 5) in northeast Texas show no evidence of sophisticated long-distance exchange (Story 1990), and neither do most early Late Archaic sites in the area of the Trinity-Sabine Tradition to the south. As discussed earlier, numerous sites in Southeast Texas show that pre-ceramic hunter-gatherer people of the Trinity-Sabine Tradition lived along the Trinity, Sabine and other rivers in Southeast Texas as well as the coastal estuaries at the mouths of those rivers at this time. As discussed previously, the Katy and San Bernard prairies show evidence of mixed use by hunters of the Trinity-Sabine, Central Texas Balcones, and Central Coast-South Texas traditions (Chapter 10).

## Central Coast-South Texas Tradition and beginnings of Lower Brazos Culture

The Central Coast area was lightly inhabited during the Middle and early Late Archaic periods, as evidenced by a few scattered hunter-gatherer sites, evidence of mostly sporadic, short term use of the shallow bays. A gap in use appears from about 2,000 to 1,000 BC, when environmental conditions along the bays were apparently not favorable for sustained use (Ricklis, n.d.). Following that period, coastal occupation resumed at a number of sites in Copano and San Antonio bays, of which the Kent-Crane site (41AS3) is perhaps the best studied (location 16, Frame 4). At this shell midden were found a variety of Late Archaic to Late Prehistoric projectile points, including Morhiss, Kent, Ellis, Ensor, Fairland, Catán, Matamoros, Darl and Perdiz. A number of shell tools were found, including whelk adzes, gouges and blades, as well as bone awls (Campbell 1952; Cox and Smith, 1988). Tubular beads made from whelk (*Busycon*) columella were found. Unfortunately, stratigraphic mixing makes placement of these various artifacts in a clear succession not possible (Campbell, 1952), but radiocarbon dating of shells at the lowest part of the midden yielded an age of 800 BC (Ricklis, n.d.), at the end of the period of time depicted in Frame 4.

During this hiatus along the central coast, there is abundant evidence of continuous occupation throughout this period along the Lower Brazos and Colorado rivers. Here termed the Lower Brazos Culture (Frame 4), it is known by a series of mortuary sites, mostly along the Brazos River, that indicate that the abundant fresh water provided by these larger rivers made life possible along that part of the coast when conditions along the drier central coast with its smaller rivers allowed only sporadic and short term occupation. Two mortuary sites, the Witte site (41AU36) at Allens Creek along the south rim of the Brazos, and the Bowser site (41FB3) along the east rim (location 17, Frame 4) contain a number of Late Archaic burials (Hall 1981; Patterson et al. 1993. 1999). Calibrated radiocarbon dates of 1210 BC and 1280 BC were obtained at five early burials the Bowser site, and 1530 BC and 2610 BC among 61 early burials at Witte. Hall questioned the age of 2610 BC date, noting possible contamination, but a Pedernales projectile point that accompanied one burial, plus the two radiocarbon dates of the similar Bowser burials, confirms an early Late Archaic age of the "Early Lower Brazos Culture" (Figure 11.1, column

B). These early burials at both sites were largely devoid of burial goods, in contrast to the rich diversity of artifacts accompanying the much more numerous later burials at both of these sites, as well as at a number of other Brazos and Colorado sites. The later burials date from around 650 BC ("Late Lower Brazos Culture") and include many artifacts that demonstrate regional-scale exchange; they are discussed in some detail in the following section.

## End Late Archaic (Early Woodland) Period, Part I : Development of the Lower Brazos Culture

The growing trends of regional exchange of material (and ideas) that had begun by the Middle Archaic and early Late Archaic in the Lower Mississippi Valley and the Wister Valley grew rapidly by the end of the Late Archaic, not just in the Trans-Mississippi Region but in all of eastern North America. These exchanges were fundamental aspects of eastern Woodland culture (Atlas V, Frame 1). In the heartland of Woodland sphere of influence in Ohio and surrounding states, the Adena culture flourished during this Early Woodland time period, from about 800 BC to AD 100 (see chronology, Figure 11.1). Adena people built impressive mounds and earthworks (an example is the Adena Mound at Natrium, West Virginia: Atlas V, Frame 1, location 6) and were hunter-gatherers who also cultivated squash, pumpkin, and sunflower. Their influence was extended considerably by the inter-regional exchange in which they participated, of which more later. Increasingly, Adena material culture is seen as not separate from the more familiar Hopewell culture that followed it, but as a direct developmental precursor of it. Mounds in southern Ohio originally regarded as Hopewell, such as the Tremper and Caldwell mounds along the Scioto River (locations 4 and 5), have been found by way of radiocarbon dating to have been started in the latter part of the Early Woodland (Adena) period, from 720 BC to AD 70 (Everhart 2020). To the north of the Adena were yet earlier people who used small, naturally occurring glacial sand knolls, or kames, to bury their dead. These "Glacial Kames" material culture burial sites have been found along the northern shores of Lakes Erie and Ontario, as far west as central Michigan (Atlas V, Frame 1, locations 9–14, and Figure 11.1, column H). As mentioned earlier, DNA evidence shows them to be predecessors of people of the Adena culture. There are strong echoes of these Eastern Woodlands cultures in parts of Southeast Texas in the apparent exchange of exotic materials and goods, described in following sections.

In the Lower Mississippi Valley, ceramic technology had a small start late in the Late Archaic Poverty Point phase, but came into abundant common use by the time of the Early Woodland Tchefuncte culture. First established in the Mississippi Valley itself, ceramic culture began to spread rapidly westward along the coast, reaching Southeast Texas in the waning years of the Early Woodland Period. This development is discussed in Part II, after review of a culture with a very different trajectory, in the Lower Brazos and Colorado river region.

## Late Archaic Lower Brazos Culture, Brazos and Colorado River Valleys

While mound cultures were thriving in Ohio and the Lower Mississippi Valley, a unique culture with similarities to those regions in burial practice and exotic grave goods was active for a short while along the lower Brazos River. This was the earlier mentioned Lower Brazos Culture (LBC; Atlas V, Frames 5a and 5b), earlier called the "Late Archaic Mortuary Tradition" by Patterson (2000). As mentioned previously, there is an early Late Archaic precursor of this culture in the lower (earlier) burial groups at both the Witte and Bowser sites (locations 3 and 4, Frame 5b); these burials are from the Early Lower Brazos Culture (column B, Figure 11.1). These burials, with no burial goods, were followed beginning about 650 BC by a larger number of burials with burial goods that range as young as about 200 BC at those sites, which is here termed the "Late Lower Brazos Culture" (LLBC) on Figure 11.1, column B. Those dates place the end of the LLBC within the Southeast Texas Early Ceramic Period, but at LLBC locations, ceramics did not arrive until well into the Early Ceramic Period.

The Late Lower Brazos Culture is roughly temporally equivalent to the Early and Middle Woodlands periods in the Lower Mississippi Valley. Grave goods at LLBC sites contain groups of marine shell ornaments, made predominantly of the lightning whelk, *Busycon contrarium*, as well as stone gorgets and copper awls that are nearly identical to others in contemporaneous burials of the Glacial Kames and Adena cultures, and are also similar to burials in the Fourche Maline culture of the Ouachita region (discussed later). In addition, at LLBC sites there are exotic syenite boatstones and other small ground stone items from the Ouachitas, as well as large and very carefully crafted chert Late Archaic corner-tang knives from central Texas.

Figure 11.4. Artifacts from the Bowser site, 41FB3, excavated in 1996 (Patter-son et al. 1999). All items are shown at the same scale and were examined as part of the study by Patterson and others (1999). A = copper awl. B = bone pin. C = group of incised bone objects. D = corner tang knife made of Edwards chert from central Texas. E = shark teeth. F = two bone projec-tile points; note asphaltum hafting at center of lower one. G = lithic projec-tile points; of the two Ellis points, the one on the left is made of translucent quartz. H–L = sandstone boatstones with associated pebbles; each boat-stone was buried inverted, with the pebbles directly beneath. M = *Olivella* beads. Photographs by the author; ac-cess to the collection courtesy of Larry and Margaret Bass.

The two most significant archeological sites of the LLBC are the aforementioned Bowser site (41FB3) (Atlas V, Frame 5b, location 4), on an erosional outlier of the Pleistocene high prairie near the valley rim that is now surrounded by floodplain alluvium, and, directly across the Brazos valley, the Witte site at Allens Creek (41AU37, location 3; Hall 1981), also on the valley rim. The Bowser site is approximately 5m down from the crest of Pool Hill, an erosional outlier of the high prairie to the north. The bodies are buried within a linear mound of nearly 2m in height, 70m in length, and 25m in width, oriented N60W. Detailed LIDAR topographic data show that the mound bears no clear geomorphic relationship to adjacent topography of either Pool Hill or of the Bessie's Creek drainage to its immediate south, and is possibly constructional. Consisting of soft sand and sandy loam, it may have been purposely built as a burial mound, but there is at present no technical confirmation of that idea. Burial use of the mound would have begun in early Late Archaic time, judging from radiocarbon dates of the burials. Also on Pool Hill, nearer to the crest, are two campsites (41FB95 and 41FB198) that show evidence of a long, probably seasonal occupation sequence from the Early Paleoindian through Late Archaic periods (Patterson and Hudgins 1987b, 1991). No pottery and only a very few arrow points have been found anywhere at Pool Hill, indicating that the area was essentially abandoned after the Late Archaic (Patterson et al. 1993).

The Bowser site burial ground contains over 35 burials (Patterson et al. 1993,

1999) in two clusters. The lower group of Early Lower Brazos Culture age consists of five burials, all prone (lying face down) oriented with heads to the east. Radiocarbon dates associated with this group are about 3230 BP (1280 BC) and 3160 BP (1210 BC), as mentioned earlier. An upper group of 30+ burials of LLBC affiliation were mostly supine (lying face up) with heads to the north; associated radiocarbon dates ranged from about 2180 to 2580 BP (230 to 630 BC; Patterson et al. 1999 and Patterson 2000. Grave goods in these later graves unearthed during a 1996 excavation (Figures 11.4–11.8) include abundant marine shell ornaments and tools made from *Busycon* as well as *Olivella*; shark teeth; incised and decorated bone implements; long-distance trade items like a corner tang knife made from central Texas black chert and a copper awl that is probably from the Lake Superior region; asphaltum from the coast for hafting points; and inland-sourced red ochre as well as sandstone manos and metates probably made from local Catahoula sandstone (see Chapter 9). With these burials were found five beautifully prepared sandstone boatstones made of local sandstone. The boatstones were found inverted over burials, each with a number of small quartzite pebbles underneath it (Figure 11.4).

Projectile points from the two adjacent Bowser campsites include a mix of Cen-

tral Texas Balcones points (Pedernales, Marshall), Trinity-Sabine styles Gary and Kent, and Ensor and Ellis points of "expansive" distribution of uncertain affinity (see Atlas II and discussion, Chapter 7). Only Ellis dart points were found directly with the burials. Other artifacts at the two Pool Hill campsites include a number of chert dart points and preforms, chert lithic cores and flakes, and quartzite hammerstones. The lithic materials could have come from cobbles upstream on the Brazos River, or from the nearby Colorado River, and indicate that lithic manufacture was occurring on the site. Pieces of worked *Busycon*, including the partial shell shown in Figure 11.5, indicate that marine shell was being worked at the site.

The Ernest Witte site (41AU36) is located directly across the broad Brazos valley from the Bowser site, near Allens Creek. This site along with the nearby Leonard K (41AU37) and Little Bethlehem (41AU38) sites (Atlas V, Frame 5b, location 3) were excavated in 1974 by the Texas Archeological Survey as part of a salvage operation prior to intended construction of a nuclear power plant; the plant was never built (Hall 1981; also see Story 1990 and Johnson 1983). The Witte site, perched upon a bluff overlooking the Brazos floodplain was part habitation and part cemetery; there are four burial groups that contain remains of 218 individuals. The Early Lower Brazos Culture burial group mentioned earlier ("Burial Group 1" of Hall 1981) contained 61 relatively simple burials, mostly devoid of grave goods. The bodies were oriented with heads mostly pointed to the southeast.

The LLBC "Burial Group 2" contained the remains of 145 individuals, most of them interred with a spectacular array of exotic artifacts. Hall found that seventy of these graves contained "dart points, marine shell ornaments, corner-tang knives, boatstones, a ground stone gorget, a graphite schist abrader, red jasper pebbles, ochre, biotite schist, various bone artifacts, deer skulls, and antlers." Many of these artifacts closely resemble those of the upper burial group at the Bowser site (Figures 11.9, 11.10). In contrast to earlier burials, Late LBC burials were mostly oriented to the northeast.

A human bone from Burial Group 2 at Witte was radiocarbon dated at 2470 +130 BP (520 BC), in the latter half of Southeast Texas Late Archaic time and near the mid-point of the Early Woodland Period of the LMV. That date is consistent with the date of the upper burial group at the Bowser site, and Hall considered it the most appropriate date for Burial Group 2. A younger date at Witte, 1590 + 80 BP (AD 360), when considered with the Bowser dates, suggests that the overall Late Lower Brazos Culture (represented by the burials with different mortuary practices and large amounts of grave goods) spanned the approximate time range 650 BC to AD 400. The later of these burials are coeval with arrival of Tchefuncte ceramics at Galveston Bay, ca. AD 100 (Aten 1983), but the Bowser and Witte burials are of a pre-ceramic people, as no ceramics were found with LLBC burials.

At Witte and nearby sites, Hall found a few younger burials ("Burial Groups 3 and 4") with scattered remains of middens that indicated that the site was later used as an occupational site, rather than restricted for use as a cemetery, in Late Prehistoric time (ca. AD 900 to AD 1400). These later two groups of burials contrast greatly in mortuary customs with those of the LLBC. Burial Group 3, considered "Transitional Archaic" (the Early Ceramic Period of Patterson 1996 and this report), contained ten burials, with only a few projectile points as grave goods, and

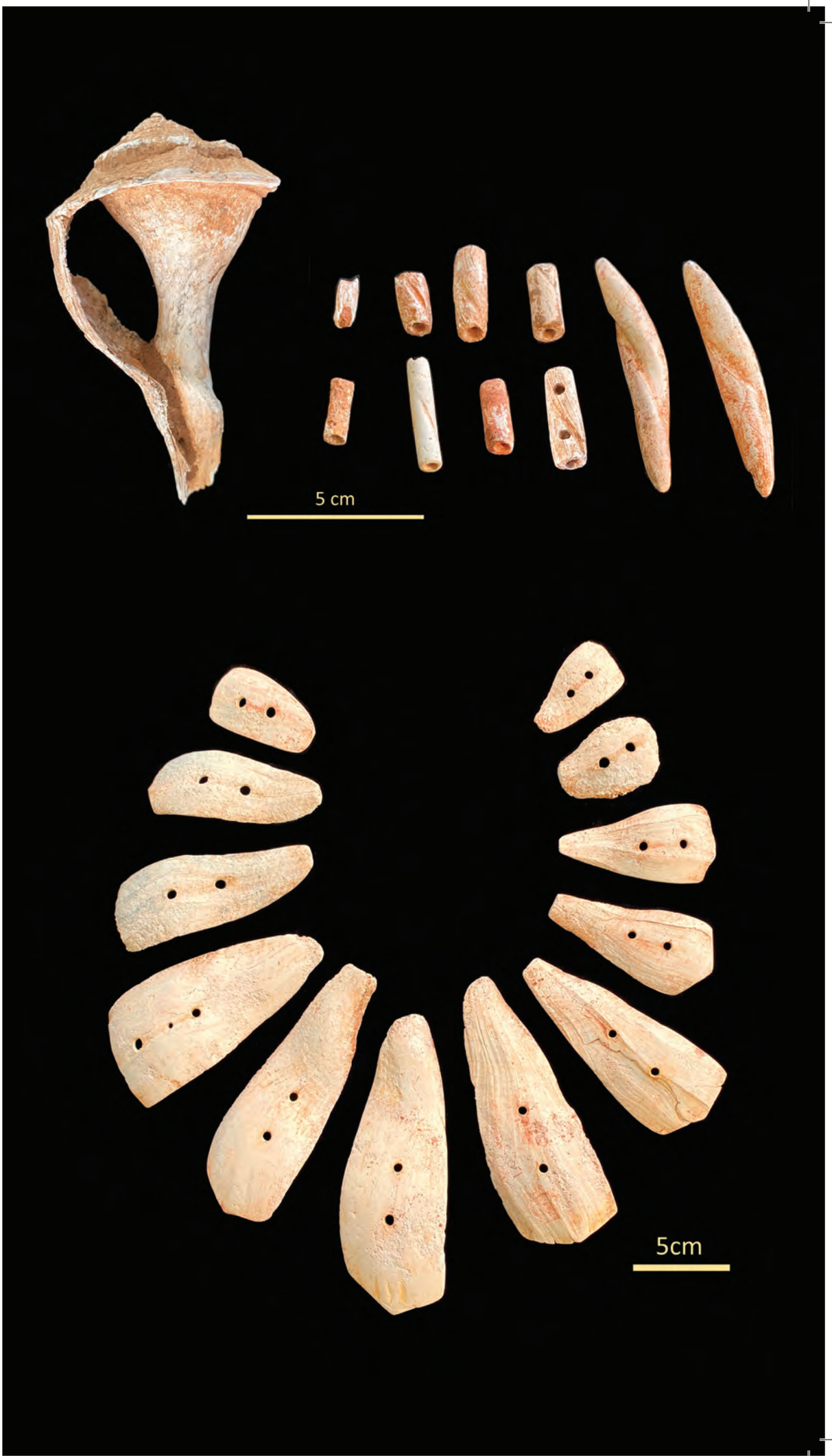



Figure 11.5 (Left): A partial lightning whelk (*Busycon* sp.) from a Late Archaic burial site of the Lower Brazos Culture, at the Bowser site in Fort Bend County (41FB03). The central columella remains, but the shell has been extensively worked, with much of the outer shell re-moved, probably for use as flat shell ornaments like pendants and medallions. Excavated in 1996 (Patterson et al. 1999). Photograph by the author.

(Right): Busycon columella beads and columellae, also from the Bowser site. Photograph by the author.

Figure 11.7. A necklace of large *Busycon* (lightning whelk) pen-dants from the Bowser site, 41FB3, excavated during 1996 by Patterson and others (1999). The cordage connecting the pendants had disintegrated. Photograph by the author.

with bodies facing the north-northwest. The uppermost and youngest Burial Group 4, Late Prehistoric, contained thirteen burials, with no grave goods and with bodies facing mostly to the east-southeast. The middens at those sites contained sandy paste pottery sherds.

The lack of ceramics in LLBC burials relative to coeval Trinity-Sabine "Mossy Grove" sites in the adjacent San Jacinto river basin, discussed later, as well as a

Figure 11.8. *Busycon* marine shell or-naments from the Bowser site, 41FB3. A, B = large and medium elongated pendants. C = pear-shaped pendants. D = three large head ornaments. E = round gorgets. F = mixed group of small pendants, rejected pieces, and debitage. G = oval scraping tool (not Busycon; probably Rangia). Photograph by the author.

Figure 11.9. *Busycon* columellae with drilled holes for stringing, from the Witte site, Allens Creek, 41AU36. Illustration from Hall (1981), courtesy of the Texas Archeological Research Laboratory, Austin.

general lack of burial goods, corner-tang knives, and *Busycon* marine shell ornaments in coeval Mossy Grove sites in the San Jacinto river basin, suggest a cultural boundary between the LLBC and the Trinity-Sabine Tradition (Atlas V, Frame 5b). By the early Historic Period, in 1528, this boundary was the location of a cultural divide between the linguistically different Coaques and Han that was noted by Cabeza de Vaca; the Coaques and Han are thought to be the Coco and the Akokisa, respectively. Swanton (1952) mapped this boundary as the boundary between the Karankawan Coco and the Atakapan Akokisa (see discussion, Chapter 4). This suggests that the cultural boundary—the divide between the Brazos and San Jacinto river drainage basins—was a long-lived one, perhaps extending back to the Early Woodland Period.

Like the large corner-tang knife at the Bowser site (Figure 11.4), the corner-tang knives at the Witte site were made of Edwards chert from central Texas. The most spectacular of them is pictured in Figure 11.7; it is the longest known, at 28.8 cm, and likely was never used; it was found with a skeleton of a female who was buried face down (Dial 2015). Some pieces of biotite schist at Witte were likely from the Llano Uplift (Hall 1981). The marine shell ornaments, mostly made from *Busycon* shells, are nearly identical to the ones at the Bowser site (Figures 11.5 to 11.9) and include an *Olivella* shell necklace. Both sites contain bone awls and other bone tools, some with impressive incised patterns (Figures 11.4C, 11.11).

A number of the items found at Bowser and at Allens Creek are clearly not from this area. Both sites contained exotic copper items thought to be sourced from the Lake Superior region: a copper awl at Bowser (Figure 11.4A) and copper bracelets at the Witte site (Hall 1981). Copper artifacts somewhat similar to those found at the Bowser and Witte sites were also found at the Jonas Short site (41SA101) in San Augustine County as well as at the Savoy Site in Liberty County (41LB27; Crook 2020a). The Bowser and Witte sites each contain several boatstones. However, unlike the Bowser site's five boatstones made of local sandstone, three of the six boat-

Figure 11.10. a. A large corner-tang knife made of Edwards chert, from the Witte site. Photo by Susan Dial, courtesy of the Texas Archeological Research Laboratory, Austin.

b. Drawing of a suggested method for hafting a corner-tang knife of the shape of the one at the Bowser site. From J. T. Patterson (1936).

stones at the Witte site, in Burial Group 2, were made of exotic igneous rocks. One is of nepheline syenite (see Figure 11.12, item a) and two others are made of an igneous porphyry; all are thought to have been sourced from the eastern Ouachita Mountains of Arkansas. Similar syenite boatstones to those of the Allens Creek site are found in association with Middle Woodland Marksville ceramic sherds at the Jonas Short mound site (location 11 on Frame 6, Atlas V; Story 1990; Jelks 2017; Perttula and Walters 2016).

Another syenite boatstone (Figure 11.12, item b) was found at the LLBC Albert George site (41FB13), near the intersection of Big River and the San Bernard River in the San Bernard Prairie, Fort Bend County (Walley 1955; location 10 on Frame 5b). Also found in the small group of burials at the Albert George site were marine shell ornaments and bone tools.

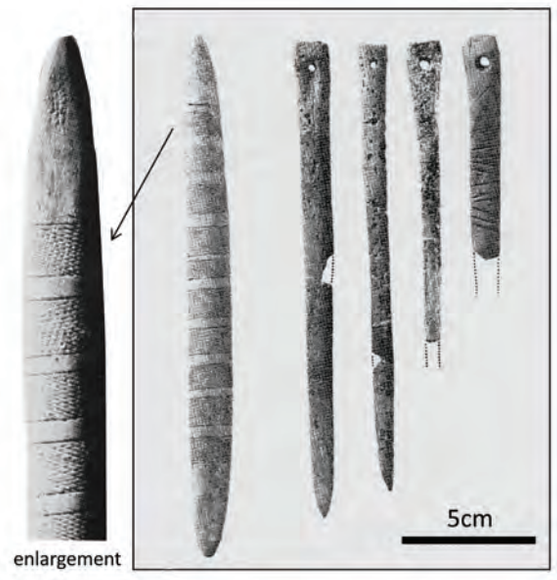



Figure 11.11. Bone awls with incised geometric patterns, Witte site (41AU36), Burial Group 2, Allens Creek, Austin County. Image modified from Hall (1981).

The grave goods of other LLBC burial sites, all considered Late Archaic, were summarized by Story (1990) and by Patterson (2000) and include:

1) The Goebel site (41AU001; location 1, Frame 5b, Atlas V): 42 burials, with marine *Busycon* shell pendants and shell beads, bone awls, sandstone abraders and a Gary dart point (Story, 1990)

2) The Brandes site (41AU055; location 2): damaged burial site; graves contained *Busycon* shell awls, pendants and beads, bone tools, and an Ensor point fragment (Story 1990)

3) The Big Creek site (41FB002; location 11): a now destroyed burial site of perhaps as many as 100 burials, as well as a diabase boatstone and a deer bone tool (Story 1990 and TARL Archives)

4) The Piekert site (41WH014; location 6): 11 burials, with marine shell and bone beads, Yarbrough point (Hudgins and Kindall 1984)

5) The Crestmont site (41WH039; location 8): 39 burials, with seed beads, *Busycon* shell beads, pendants and gorgets; antler tines, and Palmillas points (Vernon 1989; Story 1990).

6) 41FB250, which contained a large gorget made of exotic slate probably sourced from the Ouachitas (Figure 11.19b; location 5; Patterson 1997a, 2000).

7) 41WH044, which contained two burials, with various marine shell ornaments as grave goods (location 7; Black et al. 1992)

8) The Ferguson site (41FB04; Location 9): six burials, of which one had grave goods: marine discoidal shell and tubular stone beads, used as bracelets

and anklets, as well as a number of marine *Neritina* shells (Patterson et al. 1993a; Patterson 2000)

Marine shell ornaments were prominent grave goods in most of these sites, as bracelets, necklaces, and beads. Of these, *Busycon* (lightning whelk) shell was a favorite, with large pieces of outer shells making pendants, and the thick inner columellas were drilled out for use as beads (Figures 11.6 and 11.9). In addition to use as grave goods, pieces of shell ornaments were recovered at five non-burial campsites in the immediate area, within the Caney Creek drainage area of the Colorado River floodplain (Atlas V, Frame 5b, locations 12, 13). Those five sites contain not only marine shell ornaments (mostly *Busycon*, with lesser amounts of *Rangia* and cockle) but tools (a hammer and drills) made of *Busycon*, and pieces of shell debitage indicating that ornaments and tools were being shaped on site (Hudgins 1998; Black et al. 1992). Although radiocarbon dates are not available for those items, lithic and ceramic chronology indicates a Late Archaic through Late Prehistoric occupancy. Because the observed shell species can readily be found on the beach a few miles away where Caney Creek enters the sea, it is clear that the people who made them, including those with buried dead in the nearby cemeteries, included the coast in their natural range.

These five non-burial shell manufacturing sites with shell ornaments were originally located in a forested floodplain, and the area still contains a large number of native pecan trees. Cabeza de Vaca indicated in the sixteenth century that coastal people would go inland during the fall in order to collect pecan nuts, which were likely a major plant food resource. Pecans typically ripen in October. The five sites are near numerous other sites along the San Bernard River and West Bernard and Pecan creeks in the San Bernard Prairie that were sites for bison hunting, an activity that likely also occurred in the fall and in the winter (see Chapter 8). This allows an interpretation of a coastal people who migrated to the interior in the fall and winter to hunt, collect plant foods, bury their dead—and to make shell ornaments, some of which were possibly for exchange with other groups who hunted in the area during the fall.

Marine shell ornaments of Late Archaic age, although common in the LLBC, are generally not present in the rest of inland Southeast Texas (a bivalve made into an earring, found at the Kobs site by Wheat (1953; location 15, Frame 5b) is probably a freshwater species and is in any case of younger Late Prehistoric age). This is consistent with the interpretation mentioned earlier that the people of the LLBC, who lived in the region between the Colorado and Brazos rivers as well as the intervening San Bernard Prairie, were likely a separate cultural group from those in the Trinity-Sabine Tradition area (home of Akokisa band of the Atakapa in the early Historic Period) and, for that matter, from the Poverty Point and Tchefuncte cultures of the Lower Mississippi Valley, who apparently also did not use them (Gibson 2010; Ford and Quimby 1945). On the coast, well-known burial sites like Mitchell Ridge on Galveston Island and Caplen Mound on Bolivar Peninsula contain burials with marine shell ornaments of *Busycon* and *Olivella*, but no exotic lithic materials, corner-tang knives, boatstones, or copper ornaments (Taylor and Dial 2019; Ricklis and Black 2019). Both sites are younger than those of the LLBC—they were first

used in the Ceramic and Late Prehistoric periods, respectively.

**Diet.** The Joe Davis (Huntington Mound) site, 41FB223 (Atlas V, Frame 5b, location 14) is a hunting location very close to the Bowser burial site. Rather than being on the rim of the Brazos valley, it is on a natural sandy knoll within the floodplain that rises some 20 feet above the plain. Projectile chronology indicates that the mound was in use from at least Late Paleoindian time through the Late Archaic, similar to that of the Pool Hill sites (Patterson et al. 1994). A few arrow points from the Late Prehistoric Period were found, but there was no evidence of site use in the intervening Early Ceramic period. No lithic items made from exotic materials were found during the excavation, although two graves were encountered. The mound's use appears to have been primarily for hunting, as both bison and deer remains were found in addition to some 28,842 fired clayballs, indicative of hearth cooking (see discussion, Chapter 8). Only a small part of the mound was excavated, and it was estimated that total numbers of clayballs at the site could reach several hundred thousand— the richest accumulation known in the region.

The diet of people who lived at the Bowser and other Pool Hill sites included a broad range of local animal species, as indicated by bones and shells, many of which were charred and/or broken. They include freshwater mussels, alligator gar, alligators, aquatic turtles, and beaver from nearby creeks and the Brazos River as well as deer, bison, snake, turkey, duck, rabbit, bobcat, opossum, box turtle, and a possible pronghorn antelope (McClure 1993). A number of earth ovens as well as the very abundant fired clayballs demonstrated onsite food preparation (Patterson et al. 1999). Plant remains were not recovered at these sites, but doubtless included pecans and acorns that were and still are abundant in the fall along the Brazos and Colorado river bottoms. At the nearby Witte and other sites across the valley, reported faunal remains are similar, although Story (1990) notes the peculiar absence of bison at that site.

**Social change and evidence of violence.** As mentioned earlier, the burials of the Witte site's "Burial Group 2"—the Late Lower Brazos Culture burial group with the exotic grave goods—are preceded and followed by graves indicating remarkably different burial customs, and some of those burials as well as some of those at four other LLBC sites show evidence of violent death (Hall 1981; Story 1990; Patterson 2000). In addition, the number of graves of the LLBC people were strikingly more numerous than those of the people before and after their time. These facts suggest that LLBC people had some violent encounters with some of their contemporaries in the region. Evidence of violent death was noted at the following Late LBC sites (noted on Atlas V, Frame 5b):

1) Goebel (41AU 1): One burial with Gary point in rib cage (Story 1990)

2) Ernest Witte Group 2 (41AU36): One burial with three untyped points, thought to be a possible sacrifice; three burials with Fairland points; one burial with Kent points (Hall 1981)

3) Piekert (41WH014): Two burials, one with Yarbrough points, one untyped (Story 1990; Hudgins and Kindall 1984)

4) Crestmont (41WH039): One burial, point type not known (Vernon 1989)

5) Ferguson (41FB042): One burial with untyped dart point in femur (Patterson et al. 1993)

6) San Bernard Creek (41FB28): Four burials, one with a Bulverde point in the arm (Patterson et al. 2006)

These sites record a total of eleven documented violent deaths, of which four came from projectile points of the Central Texas Balcones Tradition (Fairland and Bulverde points; see Atlas II), three came from points of the Trinity-Sabine Tradition (Kent, Gary, and Yarbrough), none were from the Central Coast-South Texas Tradition, and four were of types not known or not noted. Hall (1981) was of the opinion that these violent deaths indicated inter-group conflict. As noted in Chapter 8, the adjoining San Bernard and Katy prairies were often visited by Central Texas Balcones, Central Coast-South Texas, and Trinity-Sabine hunters, pursuing bison. We know from early historical records that at the time of the visit of Simars de Bellisle in 1718, the Akokisa (Trinity-Sabine) and "Toyal" (presumably Central Texas Balcones) were rivals, and that the Akokisa band that Bellisle accompanied on a bison hunt killed and ate one of a group of Toyal that the Akokisa considered to be trespassing on their Katy Prairie hunting grounds. One would presume that at least some of the burials involving violent deaths might record similar occurrences. That the deadly dart points probably came from both Central Texas Balcones and Trinity-Sabine sources suggests that the people living in the Lower Brazos area at this time had a closer affinity to people of the Central Coast-South Texas Tradition (Aransas Focus). Before speculating further, it is best to consider the regional extent and artifact distribution patterns of the exchange sphere of the LBC and surrounding material cultures.

### Artifacts of regional exchange, Late Lower Brazos Culture

Several items found as grave goods in LLBC sites document a regional sphere of exchange with some but not all neighboring groups. Those items include exotic ground stone items, especially some boatstones and stone gorgets; marine shell ornaments; exotic copper items, and corner-tang knives made of central Texas Edwards Formation chert. As discussed later, artifacts of this regional exchange sphere came from as far away as the Great Lakes region, the Upper Mississippi and Ohio river valleys, and the Fourche Maline material cultural area in and near the Ouachita Mountains. Other nearby contemporary groups were directly involved in exchange with the LLBC, to varying extents, including the Central Texas Balcones Tradition, the Central Coast-South Texas Tradition, and the Trinity-Sabine Tradition. LLBC people were apparently not engaged in extensive trade with the Tchefuncte culture of the Lower Mississippi Valley, but ceramics originating with Tchefuncte culture were moving westward into Southeast Texas during the Early Woodland Period, reaching deep into the refugium of the Trinity-Sabine Tradition. In this section we analyze the reginal distribution of each of these diagnostic artifact types, then describe a possible exchange sphere and trade routes.

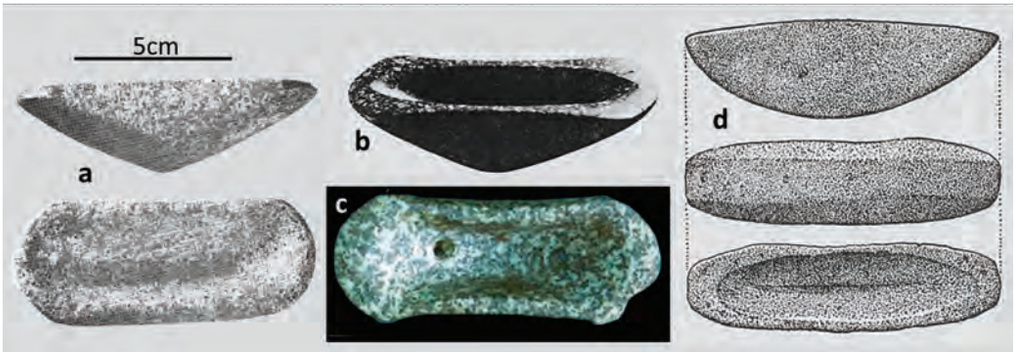



Figure 11.12. Four Southeast Texas and south Louisiana boatstones, all shown at the same scale.

a. A syenite boatstone from the Witte site (41AU36), Allens Creek, Burial Group 2. Image from Hall (1981).
b. A "green granite" (probably syenite) boatstone, from the Late Archaic Al-bert George site (41FB13) in the San Bernard Prairie (Walley 1955).
c. A syenite boatstone from the Jonas Short Mound (41SA101), probable Middle Woodland Period, San Augustine County, Texas. The boatstone has two holes drilled through its base. Image from Black and others (2003); courtesy of Texas Archeological Re-search Laboratory, Austin.
d. A quartzite boatstone from the Greenhouse site (Late Woodland), Avoyelles Parish, Louisiana; Coles Creek Period. Image from Ford (1951).

**Boatstones.** Boatstones are small stone objects (typically, sandstone), often but not exclusively found among burial goods. Those shown in Figure 11.12 are perhaps typical. They are longer than they are wide, with curved edges and sometimes a keel, and have a central concavity. There is wide variation, however. One of the boatstones at the Bowser site is higher than it is long or wide, and is shaped like a cowbell (Figure 11.4, item J), and another is short and not at all deep (Figure 11.4, item H). Boatstones from the contemporary Adena and Hopewell cultures in Ohio are often in the form of effigies, such as the two shown in Figure 11.13. Some, like those in that figure, have twin holes drilled, while others (like the Bowser site examples) do not.

The intended use of boatstones is not clearly known, but they have most typically been described as atlatl weights (J. T. Patterson 1937; Shafer 1973; Brown 1996; Perkins n.d.). It is thought that when strapped lengthwise to an atlatl, they helped store more spring energy during throwing, allowing more power in the throw (Perkins n.d.). J. T. Patterson, who made an extensive study of boatstones, subscribed to the notion of atlatl use but noted that not all were appropriately classed as atlatl weights:

> *Some of the boat-shaped pieces are entirely too large and heavy to have been bound to an atlatl, and they could have been used for ceremonial purposes. . . . It is reasonable to assume that after the atlatl fell into disuse, the Indians continued to make, in some places and some measure, the boat-stones as charms or fetishes, and hence, in time their original purpose would have been completely lost in antiquity.* (J. T. Patterson 1937)

Those at the Bowser site look particularly unsuited as atlatl weights. They are delicately carved out of a relatively soft sandstone, and their thin walls are not particularly robust. The tall "cowbell" boatstone in particular (Figure 11.4, item J) seems a poor candidate for attaching to an atlatl, and there are no drilled holes in any of the Bowser boatstones. Perhaps most significant, the five at Bowser are all associated with small quartz pebbles, and the boatstones were ceremoniously placed inverted over a burial with the pebbles beneath them. One of the Bowser site boatstones was associated with pulverized red ochre. Such careful placement at burials, with pebbles, suggests a spiritual or ritual/ceremonial use; more on that later.

The distribution of boatstones found at sites in the Trans-Mississippi South was mapped by J. T. Patterson in 1937 (Atlas V, Frame 3; also see this distribution on a

more regional map, Frame 1). Their heaviest concentration is within the Ouachita Mountains of Arkansas and Oklahoma, as shown by the counties shaded dark blue in Frame 3. They are common in the Lower Mississippi Valley and in eastern and central Texas. They are found in LMV Woodland period cultural sites and in the Fourche Maline culture's Spiro Mound of Oklahoma (Frame 3, location 2), where they are present as late as the tenth century AD. They are common in Fourche Maline culture graves of that region as old as AD 500, and are found mostly in high-status graves after that time (Brown 1996). Those are coeval with those at the Bowser and Witte burial sites that date between 650 BC and AD 250.

The boatstones at the Bowser and Witte sites are among the most southwesterly occurrences known (Atlas V, Frame 3, locations 17, 18). The five Bowser boatstones (Figure 11.4) were made of a medium-grained quartz sandstone, with a light silica cement; the sandstone contains tiny shell fragments. The lithology of these boatstones matches that of other ground stone items at the site, which appear to have been fashioned from fluvial Catahoula Formation sandstone (see Chapter 9) that outcrops about 50 km to the northwest. Patterson (1937) noted that most boatstones, like those of the Bowser site, were made of local materials, like sandstone or limestone. But many are not, and their composition tells us much about early exchange systems.

Unlike the boatstones at the Bowser site, three of the six Witte site boatstones were made either of nepheline syenite (1 occurrence; Figure 11.12, item a) or of an igneous porphyry (2 occurrences). Nepheline syenite is an unusual rock type, composed of intermediate igneous rocks that are undersaturated with respect to silica. The only known outcrops of this rock type in the Lower 48 U.S. states occur in four small igneous intrusives within and just east of the Ouachita Mountains of central Arkansas, in Pulaski, Saline, Garland, and Hot Springs counties, near the cities of Little Rock and Hot Springs, Arkansas (Smothers and others 1952; Haley 1993). The locations of the four intrusive igneous bodies are plotted on the map of Atlas V, Frame 3, location 1.

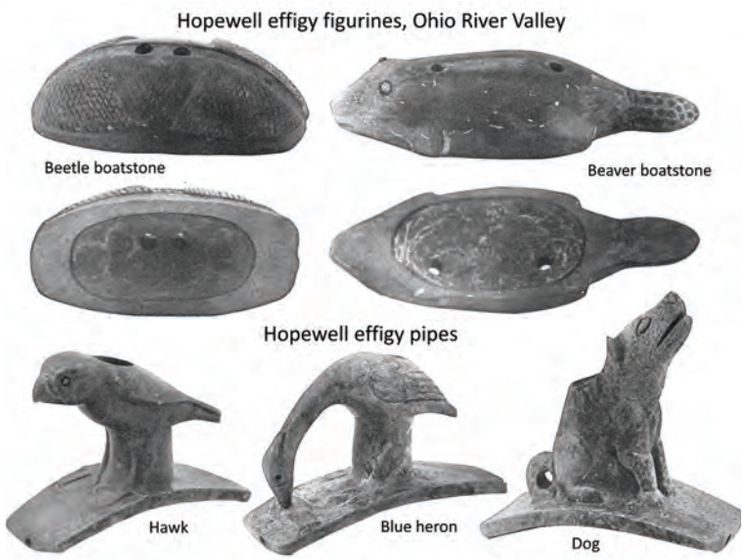



Figure 11.13. Upper: two effigy boatstones from the Tremper Mound (Early and Middle Woodland), Ohio River Valley, Scioto County, Ohio. Left, a beetle, and right, a beaver; top and bottom views of each. The stone type was unrecorded. The hollowed out, boat-like bottom with two drilled holes is similar to a boatstone from Jonas Short Mound (Figure 10.12 c). Lower: Three effigy pipes from the Tremper Mound, made of pipestone. Images from Mills, 1916.

A third site in the area of the Lower Brazos Culture containing a boatstone is the Late Archaic Albert George site (41FB13), near the intersection of Big River and the San Bernard River in the San Bernard Prairie, Fort Bend County (Frame 3, location 19; Walley 1955). A small group of burials contained, as at the Bowser site, shell ornaments, bone tools, and a boatstone made from what was described as "green granite," probably a syenite porphyry (Figure 11.12, item b). Like the boatstones at the Witte site, this artifact probably came from igneous rocks in the eastern Ouachita Mountains.

At the Jonas Short Mound (41SA101) in Angelina County (location 14, Frame 3),

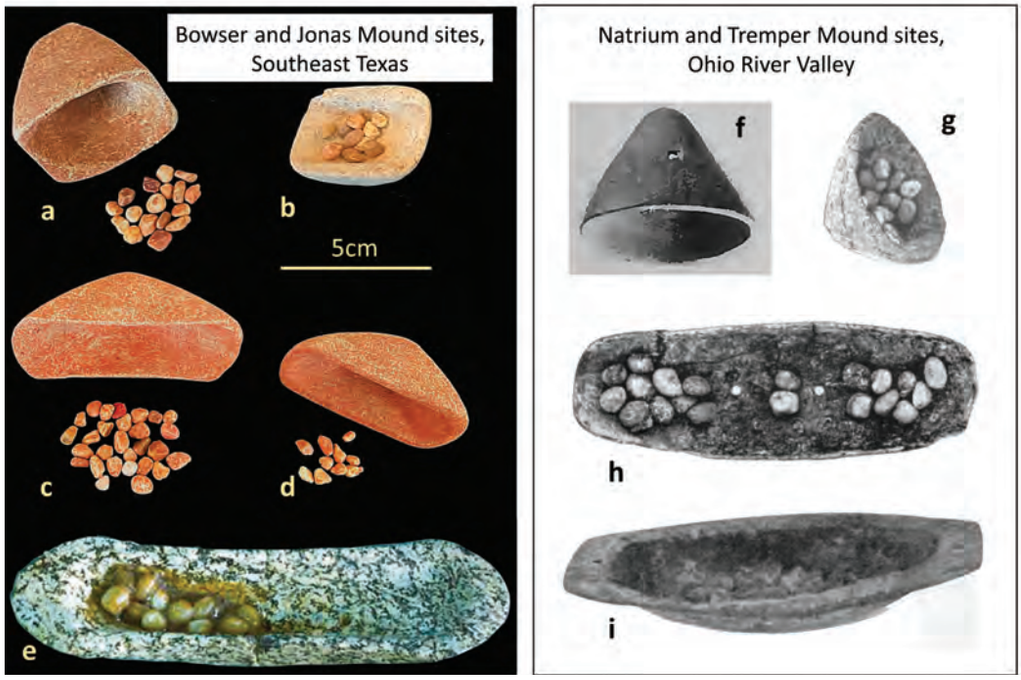



Figure 11.14. A comparison of South-east Texas and Ohio Valley boatstones. All but one contain quartz pebbles. a-d. Four sandstone boatstones from the Bowser site (41FB3), Brazos River Valley (same group as in Figure 11.4); Early to Middle Woodland. The sand-stone is likely from the local Oligo-cene/Miocene Catahoula Formation. The Bowser site was excavated in 1996 (Patterson et al., 1999. Photographs by the author.
e. Syenite boatstone from the Jonas Short Mound (41SA101), probable Middle Woodland Period, San Augus-tine County Texas. Image from Black et al. (2003), courtesy of the Texas Ar-cheological Research
Laboratory, Austin.
f. Cone-shaped boatstone made of soapstone, from an Adena culture (Early Woodland) mound on the Ohio River near Natrium, West Vir-ginia. Image from Solecki, 1953.
g-i. Three copper boatstones from the Tremper Mound (Early to Mid-dle Woodland), Ohio River Valley, Scioto County, Ohio. Each contains small quartz pebbles; those in I were intentionally broken and adhere to the corroded copper. Images from Mills, 1916.

two syenite boatstones were found in a burial mound associated with human burials of Late Archaic age (Story 1990; Jelks 2017; Perttula and Walters 2016). These two syenite boatstones (Figure 11.12, item c and Figure 11.14, item e) were sourced from materials in the same small area of the eastern Ouachita Mountains as those syenite boatstones at the Witte and Albert George sites. Like the Bowser site boatstones, one of the Jonas Short boatstones contained a number of small quartz pebbles, 22 to be exact (item e). Like the Bowser and Witte sites, the Jonas Short site contained ornamental copper artifacts, in the form of two copper bracelets likely sourced from the Lake Superior region. Also like Bowser, there were a few quartz crystals. At Jonas Short, these crystals have well-faceted ends, and one is drilled into a pendant. These are similar to the faceted quartz crystals commonly found in hydrothermal deposits in the eastern Ouachita Mountains near Hot Springs, Arkansas—near the syenite area.

In Liberty County an elliptical boatstone made of an unidentified but non-local limestone was found at the Savoy site (41LB27; location 16, Frame 3), along with two bannerstones (Crook 2019a; Crook and Costa 2019). The limestone material of the boatstone is of a non-local type, fine-grained and gray, and is thought to be of Paleozoic age from the Ouachitas (Crook 2020a). The boatstone has more of a rounded, elliptical shape than those of the Bowser site, and lacks the V-shaped keel of those items. One of the Savoy site bannerstones was made of a metamorphosed gabbro (an igneous rock) and another of slate; both are thought to have originated from the Ouachita Mountains of Arkansas. A third bannerstone from the area was found at the nearby Wood Springs site (41LB15) in Liberty County; it is made of a metamorphic greenschist apparently from the Hillabee Metavolcanic Complex in central and eastern Alabama (Crook 2019b). These items were all surface finds and are undated. Both the boatstone and the three bannerstones attest to long-distance trade.

Nepheline syenite boatstones have been found at a number of sites in Louisiana,

including one in Caddo Parish (location 7, Frame 3) and another in La Salle Parish (location 10; Patterson 1937). Others have been found within the late Fourche Maline cultural zone at the Crenshaw site in Miller County, Arkansas (location 6; Perttula 2013). This site comprises a series of earthen mounds along the Red River that were connected by a raised causeway (Schambach 1997). Another syenite boatstone was found a short distance to the northeast at Hope, Arkansas (location 4; Patterson 1937).

The syenite boatstones are of particular interest because their precise source locality can be ascertained and hence the presence of long-distance exchange can be confirmed, but the bulk of boatstones are made of local sedimentary materials (Patterson 1937), like the sandstone boatstones of the Bowser site. For example, a boatstone found at the Granger reservoir in central Texas was fashioned out of local limestone (location 20; Prewitt 1981a). Boatstones found in Wister Valley, Oklahoma are of local sandstone from the Ouachitas (location 3; Galm 1984; Rowe 2014). It may be that long-travelled syenite boatstones were a rare commodity associated with social prestige.

Beyond the eastern Texas-Lower Mississippi Valley-Trans-Mississippi region (Frame 3), boatstones are found in many parts of the Ohio and Mississippi river valleys, in mounds of the Adena and Hopewell cultures. The Tremper Mound near the Ohio River (location 4, Atlas V, Frame 1) is typical of these. When that site was first sketched in 1848, it was an effigy mound in the shape of a four-legged animal, surrounded by an elliptical embankment with a gated entrance (Figure 11.15). Though this mound was once considered solely of the Hopewell culture (Middle Woodland Period), new radiocarbon dates ranging from 720 BC to AD 70 from this and nearby Caldwell Mound (location 5) show that the mounds began in the Early Woodland Period as part of the preceding Adena material culture (Everhart 2020) and thus are contemporary with the burials of the Lower Brazos Culture in Southeast Texas; Adena and Hopewell are seen as a continuum of culture development in the Ohio Valley. The mapped range of locations where boatstones have been found in Texas, Louisiana, Oklahoma, and Arkansas (the blue line on Frame 1, Atlas V; data as shown in Frame 3) defines a salient emanating from the Upper Mississippi and Ohio river valleys, strongly supporting their broad cultural relationship to the Adena and Hopewell cultures.

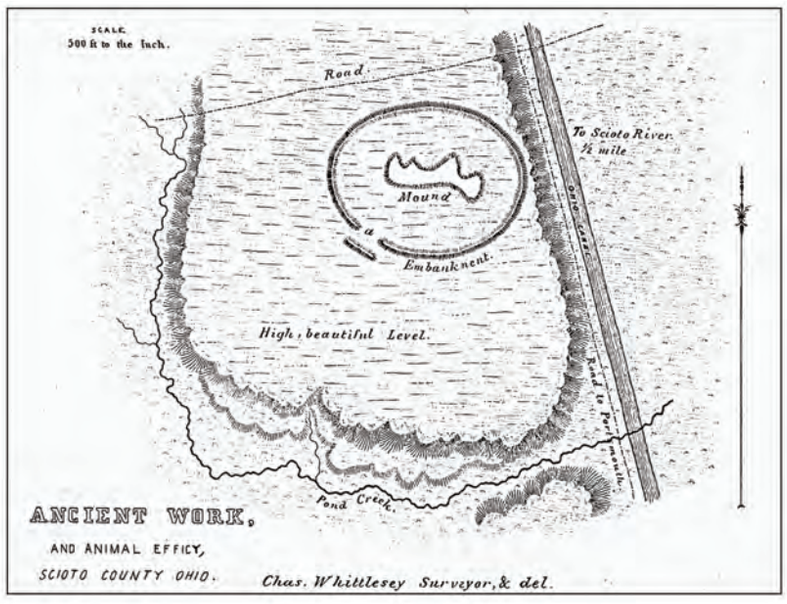



Figure 11.15. Sketch map of Tremper Mound, Scioto County, Ohio. From Squier and Davis, Ancient Monuments of the Mississippi Valley (1848:83).

Some of the cultural items at Tremper Mound have no parallels at LLBC sites, for example the finely carved effigy boatstones and pipestone effigy pipes shown in Figure 11.13. However, other boatstone items are closely similar, at least in shape and content. Three copper boatstones from the Tremper and nearby Natrium sites shown in Figure 11.14, items g–i are similar in form and,

presumably, function to those of the Bowser and Jonas Short sites (items a–e). For example, items a and g share a bell-shaped, thin-walled form, along with copper item f from the Adena Mound at Natrium. Items h and i from Tremper mound closely resemble the form of the Jonas Short boatstone (item e), and all include twin holes at their bases. Finally, except for item f, these boatstones all include a number of small quartz pebbles. The pebbles seemingly preclude use in atlatls, as the pebbles, however appended to the boatstone, would make unwanted noise during hunting. Both copper and syenite were exotic to their respective burial sites, so these were esteemed items. The pairing of pebbles with boatstones indicate to Case and Carr (2008) that these Ohio and Scioto river valley artifacts were used by shamans or leaders for divination, along with other flashier items like quartz crystals, mica mirrors, brightly colored stones, and copper balls.

The inverted placement at the Bowser site might similarly indicate some sort of ceremonial or ritual function, one that must have been partly shared in concept with those of contemporaneous groups in Ohio, 1,600 kilometers away. A search of ethnohistorical references to boatstones in eastern and southeastern Native American culture by Carr and others (2008), part of a larger attempt to add context to a large variety of Archaic and Woodland artifacts, yielded no information on the use of the boatstone. As it had passed out of archeology by the end of Late Woodland time, there apparently was no cultural memory of it by Native Americans of the region in the Historic Period.

An alternative interpretation of the thin-walled, cup-like boatstones and their inverted placement on a corpse at the Bowser site is suggested by the common use of turtle rattles, with sound made by small quartz pebbles, by many post-Woodland Mississippian groups in the eastern U.S. These turtle rattles lasted into historical times and are still in use today for ritual dances. Vogelin (1942) noted of the Shawnee:

> *Tortoise shell hand rattles were used to accompany the magical songs sung by former "powerful men" or shamans among the Shawnee. The instrument . . . consisted of a single turtle shell attached to a stick handle. After being captured, a wood turtle was offered tobacco while a formula was addressed to it. The creature was then boiled in water for an hour or so. Next the meat and entrails were removed, care being taken to keep the plastron [chest plate] intact. Both plastron and carapace were sun dried, and small holes were drilled around the edges; the two pieces were then tied together with buckskin thongs which passed through the holes. An opening about 1 inch wide was bored in the center of the bottom end of the rattle, and another . . . in the center of the top end. Quartz crystals were put inside the shell. A round stick which tapered to a point was run through the bottom and top openings and fitted with a wooden peg. . . . A cowhorn trimmed at the base and sawed off 4 inches from the tip is now being employed by the . . . Cherokee Shawnee in place of gourd rattles at religious dances. A piece of wood is fitted to the top hole of the horn, small pebbles are inserted as rattling substances, and another piece of wood is fitted in the bottom end as a handle. . . .*
>
> *From their brothers, the Creeks, the Absentee [Shawnee] borrowed a dance known*

*as the "lead" dance, which became very popular. . . . The leader, a man, heads a file of men and women dancers, and from time to time as he moves quickly around the dance ground he utters short exclamations which the other dancers "answer." Behind the leader are one, two or three women dancers who wear bulky leg shackles. Creek women, when dancing such a dance, use leg shackles made from turtle shells, so also did Shawnee women. . . . The Shawnee developed their own type of leg rattle, using small size tin cans as a substitute for turtle shells. Some 20 milk tins, each containing several small pebbles, are lashed in 4 or 5 rows to a strip of buckskin or heavy cloth which is tied around the leg.* (Vogelin 1942)

Much closer to the Brazos River, Wheat (1953), investigating Early Ceramic and Late Prehistoric burials at the Kobs site in the Katy Prairie (location 15, Frame 5a, Atlas V) found the upper half of a turtle shell placed over the chest portion of the deceased; underneath this turtle shell were a number of small pebbles. Wheat concluded that this was a turtle rattle. He did not mention any holes drilled in the turtle shell, nor was there a plastron, suggesting that it was tied in place on the body of the deceased.

Examples of both a turtle hand rattle from the Mississippian Period and a modern Creek turtle shell leg "shackle" are shown in Figure 11.16. Brown (2010) studied the process of making and using such leg rattles and noted that turtle rattles also could be bound to a dancer's limbs without using any holes (as indeed the burial at the Kobs site suggests). It seems possible that the Bowser specimens and others from this region were thin stone rattles, and their placement against the corpse, inverted with pebbles underneath, suggests that placement as rattles tied to limbs or chest. Unfortunately, the Bowser site descriptions of the burials were not detailed enough to ascribe their location firmly on the human remains.

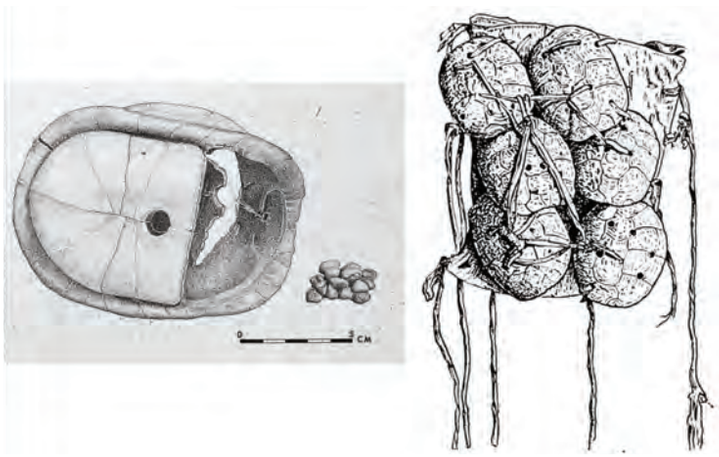


Figure 11.16. Left: Drawing of a turtle carapace rattle with quartz peb-bles, from the Zebree site, Mississippi County, Arkansas; it was found on the floor of a Middle Mississippian house. Courtesy of the University of Michigan Museum of Anthropol-ogy. Right: Turtle shell leg rattles, modern Creek Indian (Speck 1911). The shells contain small pebbles. The shells were tied together with thongs fastened to a leather sheet, and this was shackled to the dancer.

The importation of intermediate igneous rocks like syenite and "greenstone porphyry" (likely an intermediate volcanic rock like andesite) as boatstones, in either raw or finished form, indicated the existence of long-distance exchange, as mentioned. The Witte and Albert George sites in the LLBC are 790 km (490 mi) as the crow flies from the igneous stocks of Magnet Cove, Arkansas. There is no obvious waterborne way of shipping them, except by taking them down the Arkansas River by boat to the Mississippi River, then down to the coast and, again by boat, along the coast to the mouth of the Brazos—a riverine and coastal journey of well over 1,600 km. A map of Native American trails of the early Historic Period (Atlas V, Frame 9), compiled from various historical sources noted in the figure's caption, suggests one possible overland route. Assuming that these trails existed as far back as the end of the Late Archaic, a trader (or chain of local traders) could start at the nepheline syenite stocks in Arkansas (Frame 9, northern edge), then head southwest along the Nachitoches trail (Trail 7). This old Native American trail, mapped by pioneer Anglo-American fami-

lies during the early settlement era (Houck 1908), linked the area of future Cape Girardeau, Missouri, along the Mississippi River to the Native American settlements near the modern Louisiana town of Nachitoches. But our Late Archaic trader would turn off that trail as it intercepts the Trammel's Trace trail (Trail 8), which headed south to the modern town of Nacogdoches. From there, one could take the Bidai Trail (Trail 10, after Woodrick 2017; Woodrick and Linton 2009), ending up at the Brazos River just a few miles upstream of the Bowser and Witte sites. An obvious issue with this hypothesis is that both Nachitoches and Nacogdoches had their beginnings as Caddo settlements, which probably did not exist until centuries later. Nonetheless, it is possible that the geographic and anthropological need for such a route may have caused the trails to have formed earlier; the Caddo would later presumably have taken advantage of the crossing points of existing trails to found their settlements.

This conjectural trade route is sketched on the more regional map of Atlas V, Frame 10. That route is part of a potential much larger trade route discussed later. But it can be observed that the regional distribution of boatstones outlined in light blue on that map symmetrically surrounds the route just described. Boatstones appear to have emanated from the northeast, not from, say, the Lower Mississippi Valley.

None of this hypothesizing about possible trail routes gets us to a central question, however—what did the people of the Late LBC send *north* to pay for the Ouachita stone items (not only the boatstones but also bannerstones, gorgets, and other times) that moved to the south? One possibility is marine shell items from the Gulf Coast.

**Marine shell artifacts**. Marine shell ornaments are a very prominent characteristic of the Late Lower Brazos Culture. At least ten burial sites within the LLBC contain marine shell artifacts: Goebel (41AU001; Story 1990), Brandes (41AU055; Story 1990), Ernest Witte (41AU36) and Leonard K. (41AU037; Hall 1981), Bowser (41FB003; Patterson et al. 1999), Piekert (41WH014; Hudgins and Kindall 1984), 41WH044 (Black et al. 1992), Crestmont (41WH039; Vernon 1989; Story 1990), Ferguson (41FB042; Patterson et al. 1993), and Albert George (41FB013; Walley 1955). There are also five occupation (non-burial) sites with marine shell ornaments, tools, and debitage: WH080, WH032, WH083, MG050, and MG052; Hudgins 1998). The locations of all these sites are shown on Atlas V, Frame 5b, highlighted with white circles.

The large pear-shaped pendants at the Bowser site (Figure 11.8) were made of *Busycon* (lightning whelk) and are typically found singly at burials, perhaps having been worn on a string or appended to apparel. An exception was a necklace of eleven such *Busycon* pendants found at one burial (Figure 11.7). Other burials contained small round gorgets (items E, Figure 11.8) and whelk columellas drilled to be strung in a necklace (Figure 11.6), all made from parts of *Busycon* shells. A partially worked *Busycon* shell in Figure 11.5 shows where

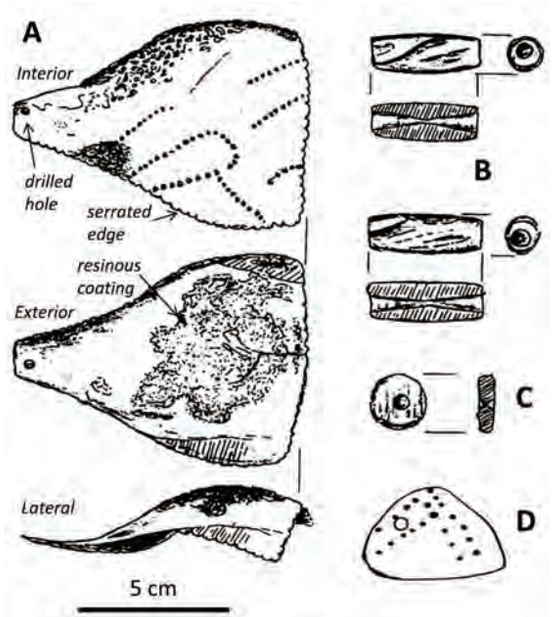



Figure 11.17. Marine shell ornaments from San Bernard Prairie burial sites, Lower Brazos Mortuary Tradition.
A = drilled and ornamented pendant made of lightning whelk (*Busycon per-versum*).
B = two beads made from *Busycon* col-umellae, both from 41WH44.
C = drilled marine shell bead (proba-bly *Busycon*).
D = small *Busycon* shell pendant from 41WH32.
From Black and others (1992) and Hudgins (1998), courtesy of the Houston Archeological Society.

the outer plates are removed from the exterior during fabrication of pendants; Figure 11.8, item F, shows manufacturing debris as well as smaller pendants made from scraps. The pendants and gorgets were drilled with one to three holes, for stringing, and the site also contained *Olivella* beads for necklaces (Figure 11.4, item M, center). Other very similar *Busycon* ornaments, with patterns etched on them and with carefully serrated edges, were found in a Late Archaic burial at 41WH44 (Atlas V, Frame 5b, location 7, and Figure 11.17, from Black et al. 1992).

As mentioned earlier, *Busycon* seems to have been considered sacred by Native Americans, perhaps because of its habit of turning in a different direction than all other whelks (Wintemberg 1908; Marquardt and Kozuch 2016). As such, its distribution shows the spread of a cultural idea or practice as well as a type of physical artifact. Atlas V, Frame 2b is a map of marine shell artifacts found in Late Archaic sites in central and eastern Texas (modified from an earlier version by Hall 1981). Such *Busycon* artifacts are found in four areas: along the central coast, especially at Copano Bay near Corpus Christi (location 1), where live whelks were once common and where some fabrication of ornaments occurred (more on that later); inland at the Morhiss site in Victoria County (location 2); inland in the area of the LLBC, including the Witte and Bowser sites (location 3); and in small numbers as individual artifacts at scattered sites in central Texas (locations near 4). They have not been found at all along the northern coast in the area of the Trinity-Sabine (and later Mossy Grove) Tradition. As mentioned, a single pair of bivalve earrings found by Wheat (1953) at the Kobs site at the Addicks Reservoir in the Katy Prairie, and reported by Hall in his compilation, were probably freshwater bivalves, and at any rate are not the *Busycon* whelk shell ornaments of the Late Lower Brazos Culture, and are not Late Archaic; they were found in a younger midden deposit, according to Wheat. Additionally, there are essentially no grave goods at the Kobs site.

It seems reasonable to assume that the stark difference in contemporaneous Late Archaic burial practices as well as use of marine shell ornamentation between the inhabitants of the central coast (cemeteries with grave goods) and the upper coast (very few Late Archaic multiple burials and essentially no grave goods) is cultural, as mentioned earlier. The central coast locations, including those of the LLBC, all fall within the boundaries of the early Historic Period Karankawa cultural group, whereas the upper coast areas—the San Jacinto and Trinity drainage basins—were occupied at that time by the Akokisa band of the Atakapa cultural group. The assumed proto-Akokisa were apparently not users of marine shell ornaments.

Following the burials in the LLBC Burial Group 2 at the Witte site, shell ornaments were not commonly part of grave goods in the later Group 3 and 4 burials of the latter part of the Early Ceramic and the Late Prehistoric Periods, indicating a pronounced shift in cultural practices.

The few occurrences of shell ornament artifacts in central Texas can be ascribed to local exchange or perhaps to trophy taking during conflict; coastal and central Texas groups both hunted in the inland San Bernard and Katy prairies, as discussed in Chapter 8, but apparently did so during separate brief encampments.

The occurrence of manufacturing debris at Bowser (and at Witte) is slight, perhaps not surprising in that they were mortuary sites, not residential sites (Birmingham and Huebner 1991). The whereabouts of fabrication sites is a matter of

some interest, because the occurrence of *Busycon* ornaments at Late Archaic and Early Woodland sites in Lake Ontario-region Glacial Kames and Ohio Valley Adena-Hopewell sites, to say nothing of similar ornaments in the Fourche Maline Tradition (see discussion later), demonstrate that these ornaments were involved in long-distance exchange with the Gulf Coast from very far away. The presence of copper items and exotic boatstones and slate gorgets at multiple LBC sites suggests a reciprocal exchange of some sort, but where was the fabrication occurring?

At the time of Hall's study, because there was then not any evidence for the local fabrication of large *Busycon* pendants along the Texas coast, Hall (1981) thought this suggested evidence for long-distance trade with Florida—and that fabrication occurred along the eastern coast near St. John's River, where early archeologist Clarence Moore in 1894 found 1,307 *Busycon* whelks from which pieces had been cut and removed. However, he reported that those *Busycon* are *Busycon carita* (Ashley, 2005), a form that spirals in a clockwise fashion, and thus not the source of Witte artifacts. Birmingham and Huebner (1991) pointed out that fabrication debitage was not to be expected at burial sites like the Witte site, as the artifacts were grave goods and the Witte burial site was not an occupation site. Research on artifacts from the Archaic Morhiss site in Victoria County has produced evidence for (limited) onsite fabrication of both pendants and tools (Dockall and Dockall 1996). The *Busycon* pendant artifacts at the Morhiss site are about the same size and style of fabrication (two to three drilled holes) as those at Witte and Bowser. Such fabrication sites are rare along the Texas coast. Another potential site is the Kent-Crane site on Copano Bay near Corpus Christi (Campbell 1952); the bays of this part of the coast were home in earlier times to large numbers of live *Busycon*. Other Late Archaic occupation sites along the central coast have yielded *Busycon* adzes, columellae awls, hammers and gouges (Ricklis 2004). Finally, several researchers have suggested that larger samples of *Busycon* are available along the coast of northeastern Mexico, and that the large *Busycon* ornaments at the (Late Woodland) Spiro Mound may have been sourced there (Hall 1981; Phillips and Brown 1978). A large *Busycon* pendant and circular beads as well as *Olivella* beads at a Texas burial site in the Rio Grande Valley (Ayala site, Hidalgo County, 41HG1) are very similar to those in LBC sites (Hester and Ruecking 1969).

As mentioned, a more likely site for fabrication of the ornaments in the Bowser, Witte, and other Late LBC burials is right in the same general vicinity as the burials. Patterson (2000) noted the presence of *Busycon* cut shell and debris as well as a chert drill with wear suggesting use in cutting holes in shell. Nearby, Hudgins (1998) described five Late Archaic and younger sites along the Caney Creek drainage (within the Brazos floodplain) where marine shell finished ornaments, partly finished ornaments, tools, and debitage have been found. The species involved include *Busycon contrarium/perversum*, Florida horse conch (*Pleuroploca gigantea)*, giant Atlantic cockle (*Dinocardium robustum*), eastern oyster (*Crassostrea virginica*), and the common brackish water clam *Rangia cuneata*. All these species can be found locally along the central Texas coast. The five occupation sites along Caney Creek (WH080, WH032, WH083, MG050, and MG052) contained removed fragments of conch whorls, broken fragments of whelk columellae, a bead blank with abraded ends made from whelk, pointed columella awls and gouges, conch

hammers, and oyster scrapers. There were large quantities of shell debitage, some unfinished or discarded ornaments, and finished pendants and beads. There were also "large quantities" of grinding stone, brought in from outside the area, that were likely used in smoothing shell edges.

The sites along Caney Creek suggest that there are other such sites downstream and along the Matagorda County coast, but that area has been little studied by archeologists—it is surely worthy of some future research. Suffice it to say that there is sufficient evidence that marine ornaments were being made directly within the occupation area of people of the LLBC and thus available for trade. All along the Caney Creek drainage are groves of native pecan trees, and Cabeza de Vaca mentioned in his account that coastal people would venture inland in the fall to harvest and eat pecan nuts (Chapter 4). The pecan nuts and acorns become ripe around October each year and would provide relatively easy sustenance—along with riverine freshwater mussels, alligator and freshwater drum as well as deer, remains of which were found at the sites—allowing time for Native American occupants of the sites to tend to ornament and tool fabrication.

There is strong evidence of a Late Archaic-Early Woodland trade in marine shell ornaments and materials between Gulf Coast people and groups in the coevaL Glacial Kames culture in the Great Lakes region as well as the Adena-Hopewell cultures of the Ohio River valley. Glacial Kames culture is named for their mortuary practice of using glacial kames (sand and gravel knolls left behind from the outwash of continental glaciers during the last ice age) as burial places, perhaps because of the ease of digging there (Cunningham 1948; Converse 1979). These burial sites stretch from central Michigan to eastern Ontario, predominantly on the northern shores of lakes Erie and Ontario (Atlas V, Frame 1). Dating the complex has been somewhat difficult, but archeologists now place the culture in the terminal Late Archaic Period, using a combination of radiocarbon dates and lithic chronology. For example, a single cremation at the Hind site in Ontario (location 10, Frame 1) was radiocarbon dated in a lab with three methods, resulting in wildly different dates ranging from 2620 BC to 160 BC. However, five of thirteen Glacial Kane sites in Ontario have bifacial projectile (dart) points of the Hind and/or Meadowood variety. Meadowood points in Ontario range from ca. 1030 to 370 BC. A Hind projectile point at the Hind site in Ontario had an associated radiocarbon date of 925 BC., and thus the cultural complex as a whole is considered as at the Late Archaic-Early Woodland transition (Donaldson and Wortner 1995). Those ages are in line with the dates at both the Witte and Bowser sites in the Late Lower Brazos Culture where *Busycon* ornaments were interred (Figure 11.1). Skeletal studies of Glacial Kames burials suggest that the people were hunter-gatherers, and socially egalitarian, perhaps not too unlike those of the LLBC.

The Glacial Kames burials contain grave goods including copper artifacts, slate bannerstones, gorgets and bird effigies, and marine shell beads, often associated with red ochre (Tharp and Chapin 2004; Keller 2009). The principal, most diagnostic artifact is a marine shell pendant in a sandal shape, made from *Busycon contrarium/perversum;* the shell material for these ubiquitous marine shell artifacts came from the distant Gulf of Mexico or possibly the lower Atlantic Coast of Georgia and Florida (see species range distribution (the brown lines) from the Global

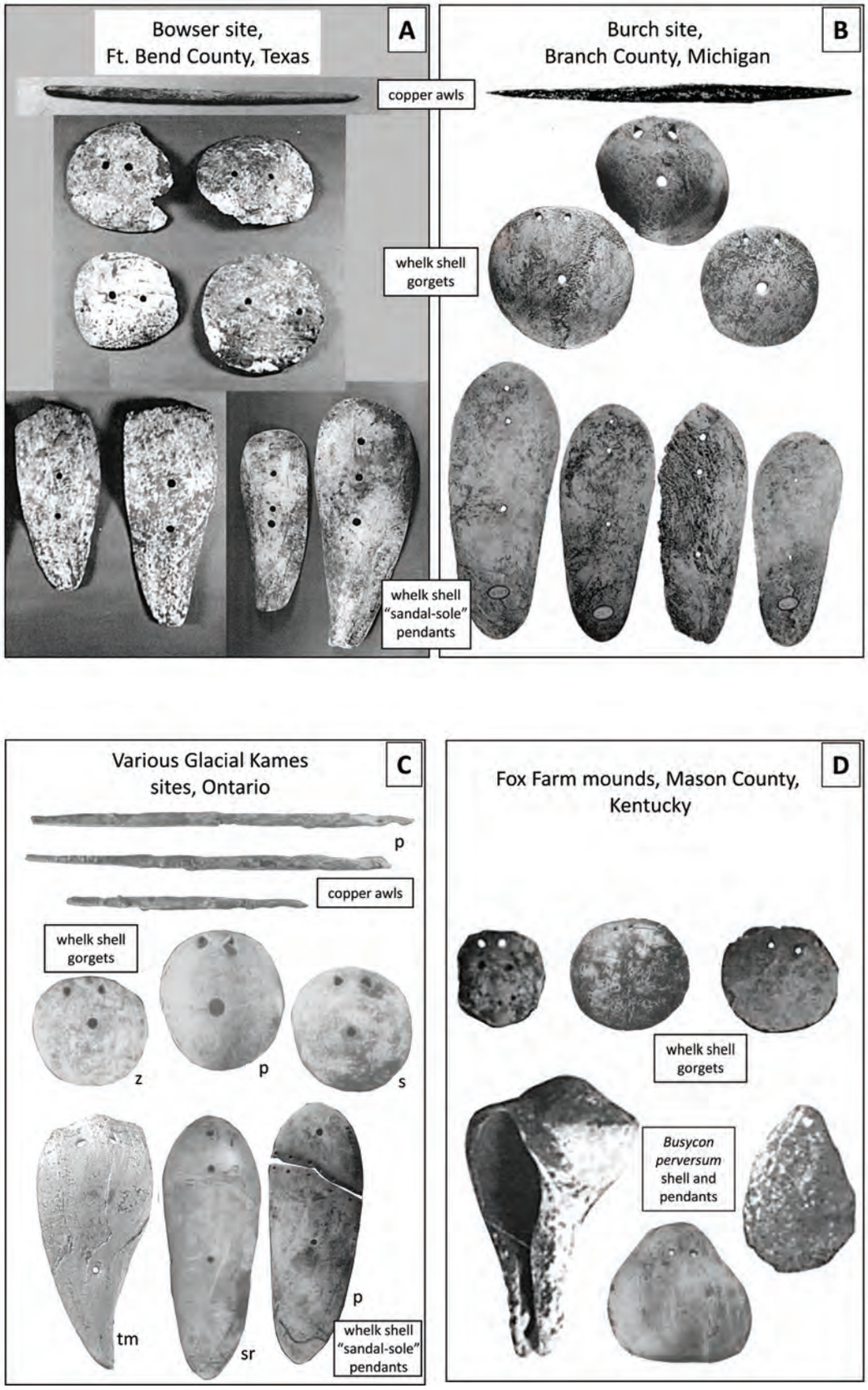



Figure 11.18. Comparison of Late Archaic *Busycon* marine shell orna-ments as well as copper awls from Texas, Michigan and Kentucky. All site locations are shown in Atlas V, Frame 1.

A. Bowser site (41FB03), Lower Brazos Culture, Southeast Texas.

B. Burch site, Glacial Kames Materi-al Culture, Michigan.

C. Various Ontario sites, Glacial Kames Material Culture: p = Picton site, tm = Trenton Mountain site, s = Schweizer site, z = Zimmer site, sr = Sartori site.

D. Fox's Farm mounds, south of Ohio River in Mason County, Ken-tucky, from Smith (1910).

Bowser site artifact photos are from Patterson and others, 1998. Burch site photos are from Cunningham, 1948; Ontario photos from Donald-son and Wortner, 1995.

Biodiversity Information Facility on Atlas V, Frame 1). Regardless of where in that distribution the Glacial Kames shell artifacts came from, it required a nearly 2,500 km-long (as the crow flies) exchange system of one sort or another.

Most *Busycon* artifacts from Glacial Kames sites closely resemble those of the Lower Brazos sites (Figure 11.18; also see Keller 2009). *Busycon perversum* whorls were made into large round gorgets as well as sandal-shaped pendants at a number of Glacial Kames sites extending from Michigan to eastern Ontario (Figure 11.18B, 11.18C; see Atlas V, Frame 1 for individual site locations); they are nearly identical to those at the Bowser site (Figure 11.18A), differing only in the details of the placement of drill holes. Burials at the Bowser site, Allens Creek (Hall 1981), and various Glacial Kames sites (Keller 2009) show that the pendants and beads were strung through the holes, and they were often found at the upper chest and necks of burials. Some were found near skulls, indicating use as hair ornaments (Keller 2009; Figure 11.8D). A pendant from the Pictin site of Ontario (Figure 11.18C, lower right) was broken and then stitched together, as evidenced by the holes along the crack; clearly these items, which had been brought from great distances, were highly valued. Similar shell ornaments to the Glacial Kames and Bowser specimens were found near the Adena-era Tremper Mound, at Fox Farm in Mason County, Kentucky, just south of the Ohio River (Figure 11.18D, from Smith 1910), and at nearby Mound City north of the Tremper Mounds, where radiocarbon dates show the mounds were in use during the first century BC (Lynott 2015). Copper awls were also found at that site (Mills 1922).

Ethnohistoric sources compiled by Keller mention the use of marine shell ornaments into the Historic Period by eastern groups. John Lawson, travelling through the Carolinas in the year 1700, noted that "the Indians often times make of a certain large sea-shell a sort of gorge, which they wear about their neck with a string" (Lawson 1714). Peter Kalm, travelling in eastern North America in 1773, mentioned that "others have a large shell on the breast, of a fine white colour, which they value very high and is very dear" (Kalm 1773). Brickell (1737) noted the price of such shell

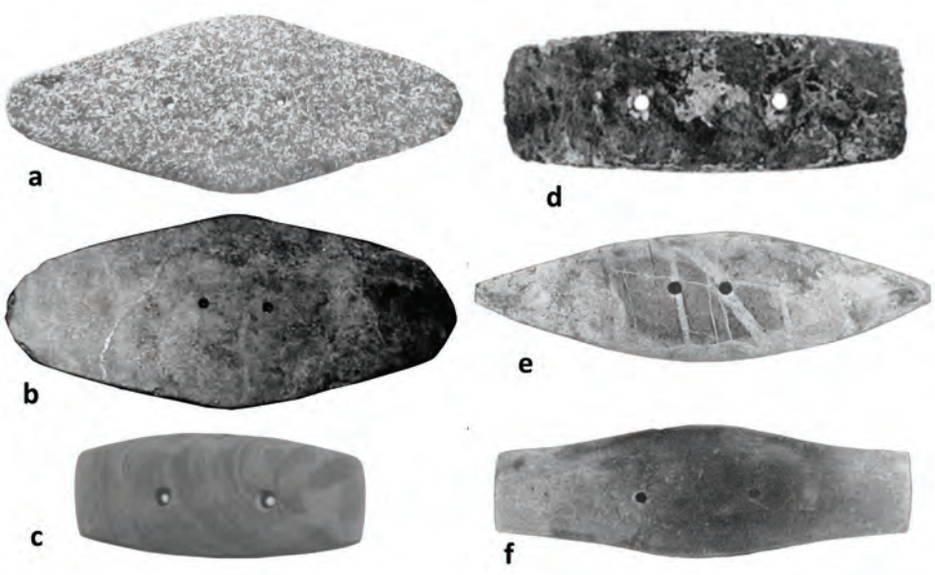



Figure 11.19. Late Archaic stone and copper gorgets.

a. Stone gorget (type unspecified), Witte site 41AU36, Austin County Texas.

b. Slate gorget from 41FB250, Fort Bend County, Texas. Two drilled holes probably were for stringing it as an ornament. The low-grade metamorphic slate is likely from the Ouachitas. From Patterson (2000).

c. Slate gorget from the Hind site, Ontario, from Donaldson and Wortner 1995).

d. Copper gorget, Burch site, Michigan, from Cunningham 1948.

e and f. Slate gorgets, Tremper Mound, Scioto County, Ohio, from Mills (1948).

ornaments: "These they wear about their necks and arms tied with a string; there are some of these gorges that will sell for three or four buckskins ready drest [sic], whilst others are only valued and sold for one doeskin." Stone gorgets were similarly worn; Skinner (1912) noted that "the single-holed form was used generally as a pendant by Iroquois owners; the double-holed variety served as a hair ornament among the Delawares." Examples of stone and copper gorgets from both the Lower Brazos and Glacial Kames sites are shown in Figure 11.19; they are broadly similar.

**Copper.** Also highly valued were items made of copper. The copper awls at Glacial Kames sites (Figure 11.18B, 11.18C) are identical in form and size to the copper awl found at the contemporaneous Bowser site (11.18A). Such copper awls were also found at the Adena-Hopewell Mound City site (Mills 1922; Atlas V, Frame 1, location 6). Other copper items common at Glacial Kames and Adena sites include copper axes, bracelets, and ear spools; copper bracelets were found at the LLBC Witte site (Hall 1981). Copper boatstones were also found at the Tremper Mound near the Ohio River, as mentioned.

The source of the abundant copper at these Glacial Kames and Adena-Hopewell sites is typically interpreted to be the Keweenaw Peninsula, Michigan as well as nearby Isle Royale in Lake Superior (location 16, Frame 1). Large cracks in Precambrian lava flows of the Copper Range on the peninsula were filled with native copper, as were pores and cracks in an adjacent conglomerate, yielding the largest native copper deposits in the United States. Copper was also found in glacial drifts, as nuggets, and early Native Americans traced those nuggets to their bedrock source on the peninsula. Because this was pure (native) copper and not a compound copper-bearing mineral, it could be extracted and used directly by Native Americans, who had no experience with smelting ore. They dug pits at the lava sites and used stone hammers fashioned from smooth cobbles on nearby beaches to separate copper from the stone lava; thousands of hammerstones have been found at these sites (Michigan State University, n.d.). Copper was then beaten into sheets and rolled to form various implements.

Although there are lesser amounts of copper in the Appalachian Mountains and in Nova Scotia, it is thought that the rich native copper deposits of the Keweenaw Peninsula provided the bulk of copper trade in eastern North America. Certainly by Middle Archaic time, Native Americans living in the interior were using log boats (see discussion, Chapter 6), and transportation of raw copper from Lake Superior to Lake Ontario by Glacial Kames people would thus have been fairly straightforward, as long as their relationships with groups living along the Great Lakes allowed safe passage. From Lakes Michigan, Ontario and Erie, short portages would get the copper into the Ohio and Mississippi River drainage basins, with riverine transport to the Lower Mississippi Valley (Atlas V, Frame 10).

**Corner-tang knives.** Corner-tang knives made of Edwards Formation chert were produced along the Edwards Escarpment and are found in smaller amounts in the prairies and plains where the central Texas people hunted (J. T. Patterson 1936, 1937b; see Atlas V, Frame 2a). A single such knife was found with grave goods at the Bowser site (Figure 11.4, item D), and two more were found at Witte (Figure 11.10), accompanying the burial of a young female, according to Hall.

One of those Witte knives was very long and exceedingly finely made (Figure

11.10a), and appears to have been unused—and is thus likely to have been a ceremonial object (Wilhelm 2015). Seven others were found at burials at the Morhiss site (Duffen 1939; Dockall and Black 2006). Five corner-tang knives found at a burial of a small child and an adult at the Silo site (41KA102) in Karnes County are of very fine craftmanship, appear to have been unused, and were perhaps manufactured as grave goods (Broehm and Lovata 2004). Others show clear signs of use; three found in Bexar County showed wear along their edges indicative of hafting as a knife (Mitchell and Orchard 1984). Patterson (1936) suggested that the tangs—the tabs at the corners—were used in hafting the blades as a knife with a handle (Figure 11.10b). Saner and Tomka (1998) used use-wear analysis to show that corner-tang knives were generally used to cut soft materials (like meat and perhaps plant material) in a push-pull motion, and were hafted. They thought that the knives were too thin to be used as scrapers. McReynolds (1984) and Reynolds (1986) observed "haft polish" wear around the tangs, indicating that some had been hafted. McReynolds also suggested that the tang might have been used to attach a thong, for hanging the tool around the waist.

The knives are considered Late Archaic. One found at the Britton site at the Waco Reservoir in McLennan County was found beneath a hearth dated at between 130 BC and 380 BC, contemporaneous with the age of the burials at the Late LBC Witte and Bowser sites.

A larger-area distribution map made by Patterson (1937b) indicates the broad distribution in small numbers of corner-tang knives across the Great Plains (Atlas V, Frame 1), documenting their association with Plains culture and bison hunting. The map shows that the distribution of the knives is strongly focused in central Texas, where Patterson and, later, Hall (1981) believed they were made, and that they were carried by hunters all across the Great Plains. Kraft (1993) points out that no corner-tang knives have been found at bison kill sites, however, suggesting that the artifacts were not used in killing or field-dressing bison. The knives are, rather, found at habitation sites, suggesting that they were used in cutting meat or other activities in base camps.

The regional distribution map (Frame 1) shows not only that the points are strongly associated with activities in the Great Plains but that those in the central Texas manufacturing zone for these knives were not directly involved in long-distance exchanges with eastern cultural areas like the Glacial Kames and Adena-Hopewell groups. The corner-tang knives found at Witte and Bowser sites are in association with graves that contained such long-distance Woodland-era exchange items. This suggests that the people of the LLBC traded with Central Texas, on the one hand (a trade perhaps including both marine shell ornaments and corner-tang knives), while, on the other, separately exchanging goods with Transitional Archaic and Woodland era groups of the eastern region of North America.

**Projectile points**. Another indication of longer distance cultural interaction emerges from recent excavations at Dimond Knoll (41HR796) on Cypress Creek in the Katy Prairie, described in Chapter 8 (results unpublished at the time of this writing). Excavations at this site found multiple burials of Late Archaic to Late Prehistoric age, and although there were no boatstones found there (the burials themselves were left unexcavated), there were various projectile points in an adjacent

soil midden from areas far to the northeast of Texas (Barrett and Weinstein 2014; Barrett, personal communication, 2019). According to Barrett, these include:

1) Adena and Florence points found in the Adena culture of the Ohio Valley, Late Archaic to Early Woodland;

2) Robbins points from the Adena culture, Early Woodland;

3) Waubesa points from the Hopewell culture, Middle Woodland;

4) Etley from Missouri and Illinois, Late Archaic-Early Woodland;

5) Motley points from the Mississippi River Valley, Late Archaic-Early Woodland.

Some of these points underscore the exchange with Eastern Woodlands groups that was suggested by the occurrence of copper awls and Gulf Coast marine shell ornaments in sites of both LLBC and Eastern Woodlands (Adena and Glacial Kames) groups. These points are very rare items in the region, and would seem to be the result of visitors leaving them behind (or travellers collecting them as trophies) rather being commercial exchange items per se.

Regional cultural interaction is indicated on a larger scale by some of the most common Late Archaic and Early Ceramic period points: Gary, Kent, and Yarbrough. As mentioned in Chapter 7 and shown in Atlas II, Frame 20, these points are common in Louisiana, Mississippi, and Arkansas sites extending to the Mississippi River, and have essentially the same area of occurrence as boatstones. Gary points are the type most frequently found at the Poverty Point site (Kent points are also present); are the most frequent style in general at sites in northwestern and central Louisiana (Ford and Webb 1956; Gibson 2010); are present in central Arkansas, where they may range as young as 400 to 1000 AD (Late Woodland Period); and are found in northeast Oklahoma and eastern Kansas (Nassaney and Pyle 1999).

At Poverty Point Mound in the Lower Mississippi Valley, a wide array of other Late Archaic projectile point types besides Gary and Kent have been found, many of them in use in the Lower Mississippi Valley and in the woodlands immediately to the west. Among them are small numbers of Middle to Late Archaic Marcos, Desmuke, and Morhiss points (Ford and Webb 1956), which are Late Archaic projectile point types with relatively focused distributions in central Texas and the central Texas coast (Prewitt 1995). These might indicate visitors from Texas to what was the largest ceremonial complex in North American during Late Archaic time, or their presence at Poverty Point was the result of trade (or trophy taking). In any event, projectile point distributions support the concept of Late Archaic and Early Woodland long-distance interaction.

### Summary: regional exchange sphere of the Late Lower Brazos Culture

With the foregoing analysis in hand, a few tentative conclusions and inferences may be drawn about the extent and nature of the exchange sphere of the people living

in the Late Lower Brazos Culture. The LLBC had a unique material culture from around 650 BC to AD 400, typified by burials with exotic grave goods including ground stone boatstones and gorgets, many of them of exotic stone; marine shell ornaments; copper awls and bracelets; and corner-tang knives. Burials also include bone artifacts, but such are ubiquitous in Late Archaic sites of the surrounding region and thus not particularly useful for discerning trade. Burials in the Lower Brazos and Colorado area both immediately before and after this period generally lack grave goods, and their people appear to lack access to or interest in most regional trade in exotic stone and copper.

As we have seen, the Central Texas Balcones Tradition to the west is almost certainly the source for corner-tang knives, and a recipient of scarce marine shell ornaments from the combined area of the Central Coast-South Texas Tradition and LLBC, but it does not appear to have participated extensively in trade for exotic syenite boatstones from the Ouachitas, nor for copper ornaments from the Great Lakes region. The Central Coast-South Texas Tradition southwest of the LLBC was involved in producing and using marine shell ornaments, but apparently did not participate in exchange for exotic boatstones or copper. The CCSTT appears to have been part of an exchange with the Central Texas Balcones Tradition for corner-tang knives, possibly producing marine shell ornaments for trade. The only known CCSTT areas where corner-tang knives have been found, in Nueces County and Victoria County (Morhiss Mound), are also the only known places in the CCSTT outside the area of the LLBC with documented production of marine shell ornaments and tools.

The Trinity-Sabine Tradition was generally not involved in the widespread use of marine shell ornaments at this end of the Late Archaic (Early Woodland) time period, nor was this material culture the typical recipient of copper ornaments and boatstones. Exceptions exist at the Savoy site on the Lower Trinity River (one boatstone), the Jonas Short mound on the Neches (copper bracelets and a syenite boatstone; Perttula 2016; location 11, Atlas V, Frame 6), and the Coral Snake Mound on the middle Sabine (location 2; boatstones and copper ornaments), but there are no recorded marine shell ornaments at those sites. Neither the Savoy nor the Jonas Short site is well dated, but charcoal in the lower layer of the Coral Snake Mound is dated at 300 BC $\pm$ 90, which is correlative with the Middle Woodland Marksville in the LMV (Story 1990:283), and just after the time of the last burials of the LLBC. The Coral Snake Mound contains Marksville sherds, demonstrating at the very least some influence from the adjacent Lower Mississippi Valley, at a Middle Woodland time partly coeval with that of the LLBC. It and the sites along the coast with Marksville-type sherds (locations 13 and 14) suggest a broad buffer zone between the Trinity-Sabine Tradition and the LMV during the Middle Woodland, as delineated on Frame 6. The Jonas Short mound, farther from that interpreted border, has predominantly Goose Creek sherds, according to Story (1990), again indicating that it dates to a later time than the Late Lower Brazos Culture.

Near the western edge of the Trinity-Sabine Tradition, at the Addicks Basin burial sites excavated by Wheat (1953), and at the aforementioned Addicks Mound (location 1, Atlas V, Frame 6), there is a paucity of grave goods, no copper, no boatstones (although there are two bannerstones), and no marine shell ornaments. These

Paleoindian through Late Prehistoric sites, within only a few miles of the Bowser site and other LLBC sites, attest to a likely fundamental cultural boundary already noted between the LLBC and the Trinity-Sabine Tradition, which is in the same geographic location as an equally fundamental boundary during the early Historic Period between the Karankawan Coco and the Atakapan Akokisa (Swanton 1911, 1952).

The contemporaneous Early Woodland Tchefuncte culture of the Lower Mississippi Valley, described in the next section, generally lacked grave goods, and with that apparently lacked copper, exotic boatstones (those apparently came in later with the Marksville culture in the Middle Woodland Period), and marine shell ornaments (Hays and Weinstein 2010). According to Bense (2016), "the absence of Adena ceremonial items indicates that there was little, if any, interaction with the Midwest [i.e., the Ohio River Valley]." Besides the lack of exotic (or local) grave goods, the Tchefuncte culture had ceramics by the end of the Early Woodland period, but ceramics were absent in the LLBC of this era (see discussion on spread of ceramic technology, next section).

With central Texas and the Lower Mississippi Valley generally ruled out as principal regional exchange partners of the LLBC during the Early Woodland Period, at least in the full gamut of trade involving exotic stone boatstones and gorgets, copper items, *and* a possible regional trade in marine shell items, a search for the focus for this regional exchange naturally turns to the north and northeast, at greater distance. As mentioned earlier, the region inhabited by the Wister Phase and Fourche Maline Phase hunter-gatherer culture was also the home of the nepheline syenite found at several sites in the LLBC. Also, according to Patterson's 1937 mapping, a number of counties in what were the areas of the Early Woodland Wister and Fourche Maline phases were the focus of regional boatstone distribution, as suggested by numbers of boatstones found (Atlas V, Frame 3). Marine shell ornaments and copper are commonly found at Wister and Fourche Maline burial sites (Galm 1984, n.d.; Wyckoff 1980). This area is thus the nearest culture to the LLBC that has the same complete mix of burial artifacts (understandably excepting the corner-tang knives).

Boatstone usage in the Midwest (Adena and Hopewell cultures) has not been systematically mapped, but from site descriptions, boatstones and other ground stone objects like stone gorgets are present, if not major artifact types. Boatstones do not appear to be present in the earlier Glacial Kames culture, which preceded the Adena, but several boatstones at Tremper mound (which began in the Adena phase) are very similar to those in the Bowser site in overall form and in the presence of small quartz pebbles (Figure 11.14), and some of them are made from copper instead of stone. Boatstones with pebbles have suggested to some a shamanistic, ritual, or spiritual usage (possibly including use as rattles) that spanned cultural boundaries. Many if not most boatstones are made of local materials (Patterson 1937a), suggesting that boatstone usage spread as an *idea* as much as in physical stone items.

As we have seen, marine shell ornaments (especially pendants and gorgets made from *Busycon contrarium/perversum*) are common in both Glacial Kames and Adena sites, as are copper ornaments and tools. The range of the shells is along the Gulf of Mexico and lower Atlantic (Florida and Georgia) coasts, but where precisely were

they coming from? Given the lack of participation in this regional exchange sphere by Tchefuncte people, and their general lack of use of marine shell ornaments, it is unlikely that the *Busycon* shells came from Louisiana. There is an extensive collection of shell artifacts, including many *Busycon* tools, from the Apalachicola River Valley in northwest Florida, with hammers, scrapers, cups and perforators made from *Busycon* parts (Eyles 2004), but no ornamental drilled pendants of the sort shown in Figure 11.8 are known. This would suggest that this part of northwest Florida was not a place where pendants were made or traded. The Crystal River site of the central part of the Florida Gulf Coast has a number of Hopewell goods, and it was proposed that it might have been a source workshop for *Busycon* ornaments, but an analysis by Blankenship (2013) has shown that the site lacks evidence of production of marine shell ornaments there.

The St. John's River area, on the Atlantic coast of Florida, has some evidence of worked marine shell, as mentioned, but of the wrong species of *Busycon*. It also has a number of classic Woodland exotic artifacts. Beginning with sites dating to about AD 100, copper artifacts (including earspool ornaments and discs), greenstone celts, galena and quartz crystals, and bird effigy pipes are found in burial mounds of the St. John's culture, along with marine shell columella beads, drinking cups, tools, and pendants (Milanich 1994), which gives support for some sort of Adena-St. Johns exchange. Earlier (Late Archaic and Early Woodland) St. Johns burials, however, lack evidence for such an exchange network, so that exchange may have been later than that of the LLBC, and there is no evidence of *Busycon* pendants like those in the Glacial Kanes and Adena sites. It is of course possible that a workshop existed somewhere in Florida for the sort of *Busycon* pendants found in the Glacial Kames and Adena sites, but if so, evidence for it appears to lie in the future.

This leaves the Gulf Coast of Texas as the most likely potential source for Glacial Kames and Ohio Valley *Busycon* shell pendants and gorgets. As mentioned earlier, there is evidence for *Busycon* pendants in the Rio Grande coastal area as well as at Morhiss Mound, but neither of these sites contains significant amounts of exchanged goods: exotic ground stone objects (boatstones and gorgets) and copper. With the presence of those objects as burial goods in the Lower Brazos Culture, evidence tentatively favors LLBC participation in a long-distance trade work with Ontario as well as the Ohio and Upper Mississippi river valleys.

Incidence and amount of copper is much higher in the Midwest than in the LLBC, which is not surprising, given its proximity to the source area on the shores of Lake Superior. Glacial Kames people had ready access to copper via water routes to Lake Superior, and that copper was available to the Ohio River Valley Adena and Hopewell people via short-distance portages in central Ohio (discussed later).

Putting it all together, there is evidence allowing an interpretation of a three-part exchange: marine shells (especially *Busycon* and *Olivella* shells) from the LLBC, syenite and other exotic stone boatstones and gorgets and bannerstones from the Wister and Fourche Maline phases in the Ouachita Mountains, and copper (and perhaps some incidental Adena projectile points) from the Great Lakes and Ohio river valley regions. How might that exchange have occurred?

A suggested, conjectural exchange route is shown in Atlas V, Frame 10. Beginning with the native copper deposits of the Keweenaw Peninsula (location 16), cop-

per would notionally have moved to people of the Glacial Kames material culture by water on the Great Lakes, all of which are interconnected. There is abundant evidence that Late Archaic people used watercraft in the form of dugout canoes, as discussed in Chapter 6. The people of the Glacial Kames culture, via short portages, could get that copper to the Adena culture along the Ohio and Mississippi rivers, and to Mississippi River valley cultures, using the Fox-Illinois, Wabash, Great Miami, Scioto, and Allegheny rivers, as shown in the figure.

Once in the Ohio-Mississippi drainage basin, the obvious route to the Gulf Coast would be through the Lower Mississippi Valley, but evidence shows that the Tchefuncte culture was not a prominent participant in this exchange, for whatever reason. The Texas alternative would likely have used an overland route. Not far from the confluence of the Ohio and Mississippi rivers is the modern town of Cape Girardeau, Missouri (location 16, Frame 10). Just south of that town, along the river, is the terminus of the Natchitoches Trace, a well-known Native American trail during the early Historic Period (Houck 1908). That Native American trail, which for the moment we will assume was present in the Late Archaic and Woodland periods, led directly to the nepheline syenite outcrops near Hot Springs (location 3) and to the Ouachita Mountains, where the slate, greenstone porphyry, quartzite, sandstone and other rock types used in making the exotic boatstones, bannerstones, and gorgets of the LLBC burials are found, in the home grounds of Wister and Fourche Maline material cultures of the era. Burials of those cultures contain the same mix of exotic goods as found in the LLBC, including copper items and marine *Busycon* shells.

From the Ouachita-Fourche Maline area, the Natchitoches Trace could be followed to another Early Historic Period trail, Trammel's Trace (see documentation in caption to Frame 9; and see Pinkerton 2016). That trail led to modern Nacogdoches (location 17), which in times later than this notional exchange was a Caddo settlement. In the Late Archaic, northeastern Texas was a sparsely populated area occupied by Trinity-Sabine Tradition hunter-gatherers; sites of the region such as Bird Point Island (41FT 201), Jake Martin (41UR12), and Yarbrough (41VN6) are devoid of evidence of Late Archaic exotic exchange goods (Story 1990), so this area, in this notional model, would have been a pass-through area with perhaps no significant participation by hunter-gathers of the Trinity-Sabine Tradition.

From Nacogdoches, there are at least two known early Historic Period Native American trails that—if in use during the Late Archaic—would have reached the lower Brazos. Both are shown in Frame 9 (trails 6 and 11), but of them only the Bidai Trail route is shown on the summary map of Frame 9.

This route is not the *only* way for people of the Glacial Kames occupation to get *Busycon* shells, but (1) there is little evidence at present for other Gulf Coast *Busycon* manufacturies of the sort of pendants and gorgets found in the Glacial Kames and Adena cultures, and (2) it is a reasonable route for LLBC occupiers to get both Ouachita stone and the copper awl and bracelets. Discarding for a moment the central Texas corner-tang knives, the exotic trade items at LLBC sites are nearly entirely from the Wister-Fourche Maline area in the Ouachitas (only the copper is sourced from farther north). Those Ouachita sites contain far more copper artifacts than the single copper awl found at the Bowser site and the copper bracelets at the

Witte-Allens Creek site, suggesting that exchange might have been carried out primarily over land between people of the LLBC and Ouachita-area cultures, and not necessarily directly with people of the Glacial Kames or Adena cultures. However, the set of Ohio Valley projectile points of Adena age found at Dimond Knoll allows the possibility that Adena people from the Midwest may have been involved personally in the trade with counterparts in the LLBC.

In an attempt to ascertain the source of the *Busycon* artifacts from a number of Late Archaic and Woodland sites in eastern North America, Claassen and Sigmann (1993) used atomic adsorption spectroscopy to assess levels of a number of elements in prehistoric sites (mostly Mississippian and younger), and compare them with control sites from around the Gulf and eastern Atlantic coast. Unfortunately, there were no modern control samples taken from the offshore Brazos area, and no samples from any Lower Brazos Culture marine shell items. Their study methods show promise, however, and could be repeated with Late Archaic samples from Late LBC, Glacial Kames, Adena, and Fourche Maline sites compared with modern shell samples from the offshore Brazos, northwest and northeast Florida coasts, and other areas.

Regardless of the processes whereby the exchange occurred, it occurred only during only a few centuries at most. The range of calibrated ages for LLBC burials (Witte and Bowser sites) is from about 650 BC to about AD 400, as detailed earlier. Burials both before and after that range at the Witte site lacked exotic burial goods and were oriented differently than the consistently northeast-facing direction of LLBC burials (Hall 1981; north-facing at the Bowser site), suggesting different belief systems before and after the establishment of the exchange system. Hall suggests that there may have been a cultural retrenchment at the end of the exchange network, with an Adena/Woodland culture retreating northeastward toward the Fourche Maline area (outlined on Frame 5a, Atlas V); the Fourche Maline ultimately developed into Caddo culture (see later discussion). Did people retreat with this retrenchment, or was it just a retreat of cultural ideas and practices? Such a scenario could be checked by mitochondrial DNA testing of LLBC burials, and comparing them with contemporaries in Fourche Maline (or, for that matter, with Glacial Kames and Adena DNA, mentioned earlier).

It would be easy to make too much of the aforementioned violent deaths at five Late Lower Brazos Culture sites, but they indicate some amount of cultural conflict. Projectile points from Central Texas Balcones Tradition and Trinity-Sabine Tradition hunters in those burials might indicate that LLBC people who were at the receiving end of those fatal projectile points were either from the Central Coast-South Texas Tradition or from outside the area. In this respect, it should be mentioned that an early Historic Period people, the Coco band of the Karankawa, lived within (or at least coastward of) the same geographic area as the LLBC. As was discussed in Chapter 4, the Coco were "a people apart." They spoke the Karankawan language, but when Spanish missions came to the region, the Coco consistently chose to go to the San Gabriel missions housing Akokisa and Bidai rather than the La Bahía missions that (unsuccessfully) tried to acculturate the Karankawa. After a bloody period of mutual violence and finally expulsion of the Karankawa by Stephen F. Austin and his Anglo colonists in the early nineteenth century, the Karankawa, when they

agreed to the terms of their banishment from Texas, sought permission to go into the Lower Brazos and Colorado River areas to retrieve their colleagues the Coco, meaning that the Coco were not a close part of the Karankawa war counsel, even though their territory directly overlapped that of the Old 300 Anglo plantations.

That certain cultural difference of the Coco is seen too in ceramic materials of the Early Ceramic and Late Prehistoric (Middle and Late Woodland) periods, discussed later. Sites in the LLBC contain proto-Karankawa "Rockport" style ceramics, but also contained "Goose Creek" style ceramics of the proto-Akokisa and Bidai (the so-called "Mossy Grove culture" that is contained within the Trinity-Sabine Tradition). They seem always to have been a people with feet in two cultural camps, and it is not difficult to think of them as descendants of LLBC people. Mitochondrial DNA studies of LLBC burials compared with Historic period Karankawa and Coco burials would be a way to sift through what is otherwise a seemingly irretrievable past.

### A note on a map of Native American trails (Atlas V, Frame 9)

The abovementioned map of Native American trails of the Texas-Louisiana-Oklahoma-Arkansas region (Frame 9) was compiled from a variety of ethnohistoric sources listed in the figure's caption. A striking aspect of it is the southwest-northeast orientation of the trails that cross the interior prairies and savannahs of Texas. Among other things, these trails carried trade between Coahuiltecan and other groups from either side of the Rio Grande in South Texas and northeastern Mexico on the one hand, and Caddo groups from northeast Texas and Oklahoma, on the other. Of two major routes, El Camino Real was a colonial-era road built on the site of an older Indian trail that was used by the Spanish for several seventeenth century *entradas* (locations 1 and 5, Frame 9). In one such entrada in June 1691, Governor Domingo Terán encountered a trade fair on the Guadalupe River consisting of two to three thousand members of three groups: Coahuiltecans from the South Texas and northeastern Mexico Rio Grande area, Jumanos from West Texas, and Caddos from northeast Texas (location 3, Frame 9; Foster 1995). Jumano traders from La Junta (on the Rio Grande in far West Texas) hunted buffalo while there and exchanged Spanish horses, salt, and garments made from buffalo and deer skins for Caddo pottery, arrow points, and dried buffalo meat, among other items. The buffalo meat and hides were taken back to La Junta (Anderson 1999). At another such trade fair in June 1693, on the Colorado River, a similar mix of cultures traded horses and human captives (Foster, 1995). The Jumanos were known to have traded widely, even visiting the Karankawa and Coco along the coast (Anderson 1999).

These trade routes provide ethnohistoric evidence of a hypothesized exchange route in prehistory called the "Gilmore Corridor" that utilized the inland prairies east of the Balcones Escarpment to enable trade between Mesoamerica and the Late Archaic and Woodland era cultures of eastern North America (Krieger 1948). Many archeologists and anthropologists have noted similarities between the two widely separated regions, such as the use of pyramids with squared-off tops adjacent to large plazas, use of various motifs on ceramics and other ornamental items, and the like. Assessing the similarities and the potential for significant transconti-

nental cultural exchange, White and Weinstein (2008) pointed out that although circumstantial evidence was tantalizing, conclusive evidence was tenuous at best. For example, mound culture in places like Watson's Brake in the Lower Mississippi Valley began at least a millennium before any similar massive structures in Mexico. Similarly, fiber-tempered ceramics from the St. John's culture of Florida and later the Lower Mississippi Valley were considerably earlier developments than Mesoamerican pottery. One exception they point out, however, is the agricultural "triumvirate" of squash, beans, and maize that developed in Mesoamerica and showed up, in eastern North American, with no local developmental precursors, about 2,000 years ago.

Krieger examined a potential migration route for those agricultural items along the nearshore Gulf Coast, partly by boat, but noted that none of the groups along the central and upper Gulf Coast was agricultural. He noted that the "Gilmore Corridor" east of the Balcones Escarpment (basically similar to the El Camino Real trail, locations 1 and 5), with its easily traversed prairie landscape interspersed with rivers and springs, would be an optimal route. Traders, like the Jumanos, were known to traverse enormous distances in single seasons, and so items like seeds could be carried through the bison-hunting zones of the prairies and savannahs relatively quickly, getting them to the eastern Woodlands cultures. An alternate route for those seeds would be from New Mexico through North Texas (White and Weinstein, 2008). Either way, these early Historic Period long distance trade routes show that indications are to be expected for the long-distance trade in exotic items between the Late Archaic Lower Brazos Culture and counterparts in the Fourche Maline culture and yet farther northeast.

## End Late Archaic (Early Woodland) Period, Part II: Spread of Tchefuncte Ceramic Technology

### Lower Mississippi Valley

Meanwhile, only a short distance away to the east, the ceramics developed in the Tchefuncte culture of the Lower Mississippi Valley were headed west, into the area of the LLBC people's Trinity-Sabine Tradition neighbors, who in the Early Historic period were the Atakapan Akokisa.

Figure 11.20. Examples of Tchefuncte pottery sherds from southern Louisiana sites. From Ford and Quimby 1945.

At the end of the Late Archaic, around 800 BC or slightly later, the first widespread, intensive use of ceramic technology began in the Lower Mississippi Valley as part of Tchefuncte material culture (Hays and Weinstein 2010; Jeter and Williams 1989). It and the slightly later Goose Creek ceramic ware of Southeast Texas share the distinction of being the only untempered Native American ceramics in North America (Hays and Weinstein 2010), although the

sand and silt in local Beaumont clays of Southeast Texas can act as a sort of temper in these early ceramics. Tchefuncte ware was distinctive in being rather crudely made of untempered clay "pulled from the ground and, without further preparation, formed into vessels" (Gertjejansen et al. 1983), but with rather sophisticated surface treatments, including stamping (Figure 8.13C, item k, is a Texas example), and incised patterns (Figure 11.20); others were plain and unstamped. Use of early Tchefuncte ceramics is documented in a number of sites along the Lower Mississippi Valley, as shown in the map of Atlas V, Frame 5a.

These were pre-agricultural hunter-gatherer people, living in small villages along lowland drainages in inland back swamps of the Lower Mississippi floodplain, where typical food resources like fish and freshwater mussels were easy to find. Near the intersection of the Saline and Ouachita rivers in central Arkansas are a few Tchefuncte sites (Jeter and Early 1999); they likely were brought along the Ouachita from the nearby Lower Mississippi Valley (location 15, Frame 5a). Archeological sites in the Mississippi floodplain are typically earth middens, sometimes associated with small mounds. The proliferation of exotic materials that was so prominent in Poverty Point material culture appears to have slowed markedly during the time of Tchefuncte culture (Gibson 1974).

**Louisiana Coastal Zone**. In low coastal areas people lived on raised chenier ridges or upon relatively higher Pleistocene terraces (McIntire 1954). The Chenier Plain of southwestern Louisiana comprises a series of beach ridges that are a few feet higher than adjacent marshes; these old beach ridges get younger going seaward, indicating an aggrading coastline throughout Late Archaic and Woodland time (see Chapter 2). The beach ridges and nearby brackish water lakes in the marshy lowlands of the coastal plain were sites of a number of small settlements throughout Woodland time, and they contain both shell and earthen middens—typically, residential sites—as well as a few large *Rangia* and oyster shell mounds that reach as much as 8 m in height. Alligator Mound, located on the inner part of the Chenier Plain south of Grand Lake, at Chenier du Fond (Atlas V, Frame 5a, location 12) was the site of a large *Rangia* shell mound in the form of an alligator when first described in the mid-nineteenth century (McIntire 1954). It was described as a quarter mile long (400 m), 400 feet wide (245 m), and over 25 feet high (8 m). By the 1930s half of it had been eroded by wave action, and today there is little left, as it was mined for road material. McIntire found numerous Tchefuncte ceramic sherds, establishing this as an early Tchefuncte site, one of several in the Chenier Plain. Although McIntire did not find Plaquemine ceramics at this site, Fred Kniffen of Louisiana State University reportedly obtained a Plaquemine culture era date (AD 1200–1700) from the mound (Gremillion 2019), so it appears to have been reoccupied.

The Coppell site (16VM102), a Late Archaic burial site near the coast in Vermilion Parish (location 11), is a pre-ceramic burial site containing various lithic chipped stone tools and points, cut and drilled bone tools, an atlatl hook, asphaltum, and a boatstone as burial goods. Red and yellow ochre adorned 33 flexed burials (Gagliano 1977; Ford and Quimby 1945). Ford and Quimby assigned the cemetery to the Tchefuncte phase, but there were no ceramics. The presence of a boatstone is consistent with an Early to Middle Woodland Period age. McIntire (1954) reported several nearby earth middens with Tchefuncte ceramics.

The Morton Shell Mound (16IB3; location 13) is a large multicomponent shell mound near Weeks Island, with artifacts assigned to the Poverty Point through Plaquemine cultures. Tchefuncte artifacts appear to define the dominant phase (Neuman 1972). It may have been occupied on a seasonal basis (Byrd 1976).

Coastal Tchefuncte culture was broadly similar to that of the Late Archaic hunter-gatherer cultures that preceded it, with the addition of ceramics providing the main difference (Jeter and Williams 1989). It has been said that at the end of the Late Archaic, a new people (presumably coming from the Lower Mississippi Valley) arrived in the Louisiana coastal zone, bringing with them the ideas of burial mounds and ceramics (Jennings 1952). The grey shading on Frames 5a and 5b depicts the spread of Tchefuncte ceramics westward.

## Tchefuncte ceramics arrive in Coastal Southeast Texas

Whether the migration of ceramic technology to Southeast Texas represents a migrating *people* coming from the east or rather a migration of *ideas and technology* is difficult to say, but that migration progressed westward along the coast to the Texas border. Tchefuncte Plain ceramics show up around Sabine Lake along the Sabine estuary at about 70 BC, and by AD 100 both Tchefuncte Plain and some Tchefuncte Stamped ceramics had shown up around Galveston Bay and Clear Lake (locations 4 and 3, Frame 5a), according to Aten (1983). An occurrence of Tchefuncte-related material at the Resch site along the upper Sabine River (location 6) and possible

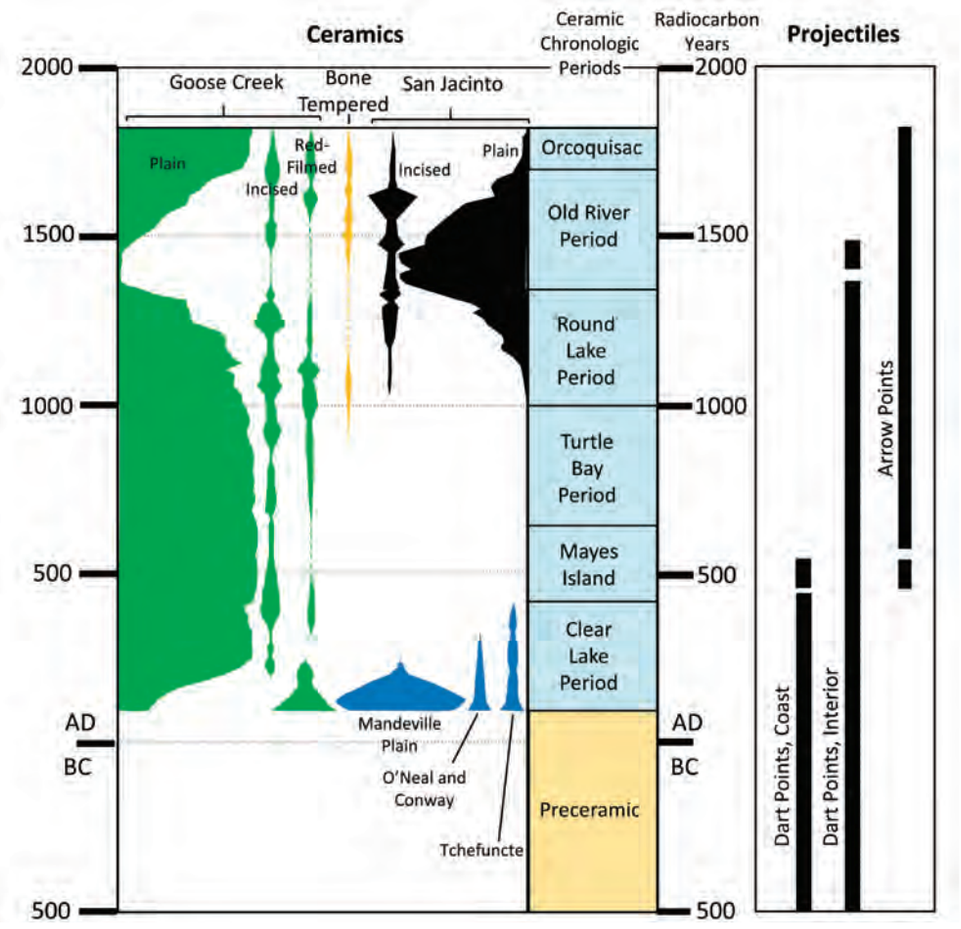



Figure 11.21. A chronology of ceramic and projectile technology in the Galveston Bay area. Ceramic types are shown as seriations, or patterns of lenticular time-frequency distributions for sites around the bay. Modified from Aten (1983).

Tchefuncte Plain sherds at Coral Snake Mound on the Louisiana side of the Sabine (location 5, Frame 5a), suggest that Tchefuncte technology had made its way up the Sabine River from the coast. Artifacts at the Resch site have an overall age range of 500–100 BC, so ceramics arrived there quite early (Story 1990:246).

A larger scale map shows more detail for the geographic distribution of Tchefuncte and contemporaneous non-ceramic sites in Southeast Texas (Atlas V, Frame 5b). Those Tchefuncte occurrences around Galveston Bay and Clear Lake are dated by Aten at ca. AD 100 and presumably mark the entry point of ceramic technology that was moving along the coast westward from Lake Sabine (see chronological chart, Figure 11.21). Galveston Bay people, as was discussed in Chapter 8, hunted seasonally in the adjacent Katy Prairie, and Tchefuncte ceramics are found at some of those sites. For example, small numbers of Tchefuncte sherds were found at the multicomponent Alabonson Road site along White Oak Bayou (Ensor and Carlson 1991), in an area used for seasonal deer and bison hunting (Frame 5b, location 16; see discussion, Chapter 8).

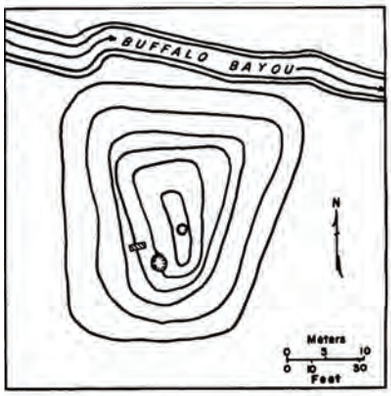



Figure 11.22. Addicks Mound (41HR001), western Harris County, east of Barker Dam, as surveyed by Marshall Black prior to its destruction in 1946 during flood control operations on Buffalo Bayou. From Joe Ben Wheat (1953), courtesy of the Smithsonian Institution.

A westernmost set of Tchefuncte occurrences is in the Addicks-Barker reservoir area, at the Kobs site (41HR07) noted by Wheat (1953). There is some controversy about the Wheat's assignation of the sherds at the Kobs site to Tchefuncte (Aten 1983). However, Marshall Black (1951) found some Tchefuncte Stamped at the nearby Addicks Mound site (41HR01) on upper Buffalo Bayou (both sites are at location 15, Frame 5b). Black found Tchefuncte sherds in the bottom layer of Addicks Mound, which was destroyed in 1947 by flood control work. This mound was a low earthen mound of about 4 feet in height with lateral dimensions of 100 by 110 feet (Figure 11.22). A small trench excavated by Black yielded a burial, and local farmers had previously encountered others. The Addicks burial mound resembles those at Lafayette Mounds in the Lower Mississippi Valley (Frame 5a, location 8), where there are several mounds of similar height and diameter, also laced with burials and accompanied by Tchefuncte material.

Addicks Mound and a complex of three large shell mounds that formerly existed in Port Neches (location 4,Frame 5a; see Chapter 4) are the only other known mounds of the Trinity-Sabine Tradition (later to become the Mossy Grove Culture) in Southeast Texas (the small Bowser burial mound, mentioned earlier, is associated with the Central Coast-South Texas Tradition). Sadly, the Port Neches mounds were not studied before they were destroyed, but were observed to contain pottery sherds (Block 1977), and presumably had origins similar to those of the Alligator and Morton shell mounds of coastal southwest Louisiana discussed earlier. There are numerous earthen mounds in the Lower Mississippi Valley with Tchefuncte associations; those listed by Hays and Weinstein (2010) are shown with blue star symbols on Frame 5a.

The position of Tchefuncte ware at the basal layer of a solitary Addicks Mound suggests that people with knowledge of mound making may have come along with the migrating Tchefuncte technology, and that it was not just the spread of a new technical development down the coast. It need not have taken many people. Pottery was made by women among early Historic Period Native American peoples in the LMV and Southeast Texas (Chapter 4). Dyer (1917), using documents from early

nineteenth-century area settlers, noted that Atakapans typically bartered with other tribes for wives, as there were often more males than females in Atakapan groups. It could be that the steady westward spread of Tchefuncte ceramics, and perhaps also the concept of burial mounds, spread with cross-band brides across tribal and intra-tribal boundaries. It was a process that took several hundred years from pottery's inception in the LMV (ca. 800 BC) until it arrived in Galveston Bay (AD 100), suggesting that it was not just an early, travelling ceramic adopter from the LMV who trumpeted the find down the coast.

### The Fourche Maline Tradition

The Fourche Maline culture (see map, Atlas V, Frame 5a, and chrnology, Figure 11.1) was the successor to the Late Archaic Wister Phase of southeastern Oklahoma. A Fourche Maline burial mound at the Johnny Ford site (Atlas V, Frame 5a, location 14, top center) contains Gary projectile points, double-bitted stone axes, and ceramics that are among the earliest in southwest Arkansas: Williams Plain pottery (Schambach 1982). Williams ceramics are plain, grog-tempered utility pieces that are different than untempered, decorated Tchefuncte ware, and are indicative of the earliest Phases I and II of the Fourche Maline material culture, thought to be a likely ancestral culture of the Caddo (Schambach and Early 1994; Schambach 2002). Three other sites shown on Frame 5a in northeast Texas contain Williams Plain ceramics (from west to east, the Sanders, Snipe and Knight's Bluff sites; Story 1990). A recent effort by Leith (2014) to revise Fourche Maline chronology at the Williams site in southwest Le Flore County of southeastern Oklahoma (the site is just north of the edge of Frame 5a) estimates that his Phase I—which is defined by the emergence of ceramics in the region—began at about 300 BC (Figure 11.1, column E). This phase at the Williams site is also marked by an increased abundance of the Late Archaic Gary projectile point, and the arrival of a stemmed axe or hoe that suggests a more sedentary population. The cemetery at the Johnny Ford site was a cremation cemetery, with no parallel in Tchefuncte culture (Jeter and Williams 1989) or in Trinity-Sabine Tradition cultures.

## Early Ceramic Period: Mossy Grove and Marksville/Troyville Cultures

The spread of ceramics, once introduced to the areas of the Fourche Maline and Trinity-Sabine material cultures, was rapid, and local variants began to flourish. In the Lower Mississippi Valley new "Marksville" mound cultures arose that had clear connections with the emerging Hopewell culture—the successor to Adena culture—of the Ohio River Valley, and a distinctive new style of decorated ceramics emerged. The Early Ceramic (= Middle Woodland) periods of each of these areas is discussed below.

### Trinity-Sabine Tradition, Mossy Grove Culture

During the Early Ceramic period (100–600 AD), all groups in East and Southeast Texas, southwestern Louisiana, and the Lower Mississippi Valley were hunter-gatherers. The Early Ceramic Period marks the time of the first *widespread* use of ceram-

ics in Southeast Texas, immediately following the brief local arrival of the Tchefuncte form (Aten 1983; Patterson 1996), and that beginning of widespread use defines the base of the Early Ceramic Period in Texas, at about 100 AD. It is a time-transgressive basal boundary, because as Aten notes, ceramics did not arrive in the Lower Brazos area until AD 200, and in the Conroe-Lake Livingston area not until AD 500. Starting at former Tchefuncte sites around Sabine Lake and Galveston Bay, ceramic technology expanded outward to nearly all parts of the project database area as well as sites as far north as the Neches-Angelina rivers area of East Texas (Story 1990; Atlas V, Frame 6).

In Southeast Texas within the area of the Trinity-Sabine Tradition, a new, distinctive form of ceramics emerged—one that would continue in use until the beginning of the Historic Period. Goose Creek Plain is a simple sandy-paste, untempered pottery, the sherds of which constitute perhaps 90% of site samples in the project area (Figure 11.23). A decorated version, Goose Creek Incised, had inscribed patterns around the upper lip of Goose Creek bowls, beakers, and jars, and sometimes contained a red or tan slip (Figure 11.24). A number of photographic examples are shown in Figures 8.13, 8.17, and 8.18. To distinguish this pottery type and the culture that produced it from Woodland Period cultures of the Lower Mississippi Valley, Story (1990:256) proposed the term Mossy Grove Culture, which is followed here (Figure 11.1, column C). Goose Creek developed more or less contemporaneously with the arrival of Tchefuncte ware in the Galveston Bay area at AD 100, as the chronological chart of Figure 11.21, from Aten, shows.

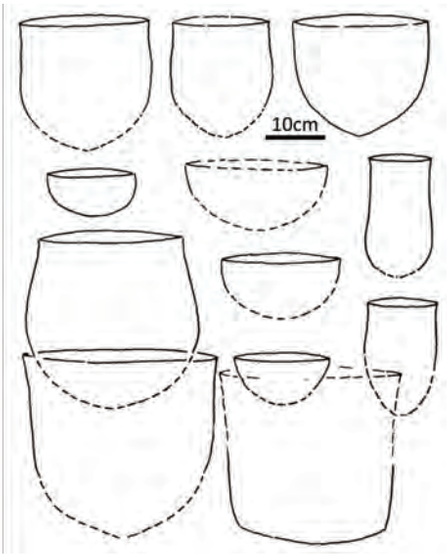



Figure 11.23. Representative shapes of Goose Creek ceramics, from samples at Cedar Bayou near Galveston Bay. From Ambler (1967) as redrawn by Black (1987). Image courtesy of the Houston Archeological Society.

**Classification disjuncts, Southeast Texas and southwestern Louisiana**. The definition of the material cultures of the Lower Mississippi Valley—the classic Louisiana archeological sequence Tchefuncte-Marksville-Troyville-Coles Creek-Plaquemine (see Figure 11.1, column F)—has its roots in the work of Louisiana archeologist James A. Ford in the 1930s, much of it as federally funded WPA projects during the Depression years. Ford based his chronology on differences in decoration as seen in pottery sherds, because small sherds rather than whole pots are the form most often encountered at archeological sites (Figure 11.20 shows, for example, the differences among typical rather simple Tchefuncte and more ornate Marksville sherds). Using careful stratigraphic documentation at many sites, the types were placed in a temporal chronology of "phases." In the LMV, Tchefuncte "phase" (or in common use, "material culture") is placed in the Early Woodland period, Marksville is Middle Woodland, and Troyville and Coles Creek are Late Woodland (Figure 11.1, columns F and G). The Southeast Texas Early Ceramic Period (column A) is the temporal equivalent of the Middle Woodland and early Late Woodland periods.

William McIntire (1954), as part of a PhD dissertation project, took the ceramic classification and chronology developed by Ford and others into the coastal country west of the LMV, where he found a mixture of small mounds and shell middens that had identifiable ceramic sherds. Sherds were classed by decoration type, and the classic LMV types (Tchefuncte, Marksville, Troyville, etc.) were described. Meanwhile, Aten (1983), working at Galveston Bay, had a difficult time with such a classification, because the vast number of Goose Creek sherds were "plain" (un-

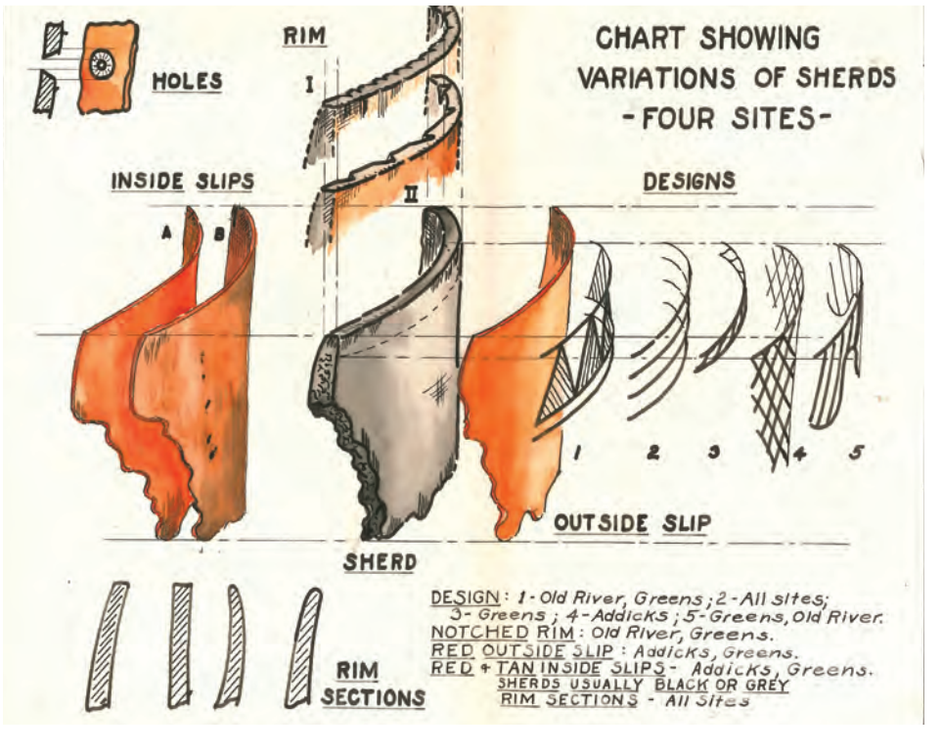



Figure 11.24. Design elements of Goose Creek ceramics, including rim shapes, internal and external slip types, and incised designs, from samples at Addicks Mound, Greens Bayou, and Old River. Unpublished drawings by Marshall Black, ca. 1955, courtesy of the Houston Archeological Society.

decorated). As can be seen from frequency of occurrence plots on on Figure 11.21, the vast majority of Goose Creek ceramics are undecorated, and those few that were incised had only very simple patterns at the rim. The question was how to use Ford's techniques of devising a ceramic chronology in such a decoration-challenged environment? Aten's solution was to pay more attention to the composition of the clay, in terms of its tempering. Tempering is the addition of materials like sand, grog (bits of old pots), and bone to the clay to keep it from cracking during firing—something of which potters gained experience over many generations. In Aten's words,

> *In my judgment, the key to an integrated taxonomy for Gulf Coast ceramics is to recognize the evolutionary succession which has occurred there in basic ceramic past technologies. Possibly beginning with fiber-tempered wares . . . we first have temperless wares (such as Tchefuncte, Goose Creek, and Mandeville) succeeded by tempered wares. Among the latter the earliest are sand-tempered (such as Alexander, O'Neal, and Conway), followed by grog-tempered (such as Baytown, San Jacinto, and Marksville), followed in the western Gulf by bone-tempering (such as Leon Plain . . . ) and shell-tempering (such as various Caddoan and Mississippian plainwares).* (Aten 1983:221)

With such a methodology, Aten developed seriations—relative frequency distributions of ceramic types tied to radiocarbon dates—for the upper Texas Coast, and developed a set of temporal ceramic periods as the finished chronology (the light blue ceramic periods in Figure 11.21). Changes of other technologies—for example, the development of the bow and arrow—are added to that figure for reference.

The rub is that Aten's classification, based upon paste composition, is completely incompatible with Ford's ceramic classification based upon surface decorations, used in the adjacent LMV. This yielded a disconnect in discussions of cultural development between Southeast Texas and southwestern Louisiana that has lasted to the

present day. In order to address the issue, Aten and Bollich (1969) tried to compare the chronology of LMV ceramic types that were traced into coastal southwest Louisiana by McIntire with Galveston Bay pottery types defined by Aten. A comparison of the two classifications was undertaken at a midpoint location at Sabine Lake, where a temporal correlation was made between the two chronological systems, and it was tentatively concluded that following the early introduction of Tchefuncte ceramics at about AD 100 in the Galveston Bay area, sandy paste pottery such as Goose Creek Plain and Goose Creek Incised developed as a local *indigenous* form, separately from the LMV tradition, which was largely grog-based. Exactly how far east that indigenous, Mossy Grove or Goose Creek sandy paste ware extended is not something that Aten and Bollich could determine in their study. Of the LMV sherds found by McIntire in the coastal zone, they note:

> *It has been our experience . . . that diagnostic sherds from the Lower Mississippi Valley area do not occur in sufficient numbers to serve as chronological markers in very many sites, or zones within sites. More importantly, such a scheme does not deal directly with the indigenous ceramics. Indeed, it seems to us that any seriation scheme which utilizes less than 1.5 percent of the artifacts recovered is questionable in the very least.* (Aten and Bollich 1969:247)

They used the few LMV ceramic sherds found in the Sabine Lake area (noted by McIntire) to help temporally constrain their Sabine Lake seriation, but left unanswered how far east "indigenous" Goose Creek plain ceramics ranged into Louisiana—a question that remains unanswered today. On the maps of Frames 6 and 7a, McIntire's classifications of LMV types (Marksville, Troyville, Coles Creek and Plaquemine) are depicted as the blue colored cores of circles that are wrapped in a light green outer shell representing the potential, uncalibrated amount of "indigenous" Goose Creek plain sandy paste ceramics, and the whole troublesome area is marked as a "Zone of Uncertain Classification," angling across the center of the frames. The LMV sherds that McIntire found, however, indicate a clear influence of LMV cultures on the area—a "buffer zone." Yet, at the end of the Late Prehistoric Period and the beginning of the early Historic Period (Frame 8, discussed later), the drainage divide between the southeast-flowing waterways of the Lower Mississippi Valley and the southwest-flowing waterways of the Mermentau and Calcasieu rivers of southwestern Louisiana is noted by Swanton (1911, 1952) as a sharp, prominent ethnic and linguistic boundary between the Atakapa to the west and various LMV cultural groups to the east. The Atakapa extended east as far as the Vermilion River (Frame 8, from Swanton's work), and that is the suggested cultural boundary shown in the map of Frames 6 and 7a, as it seems very likely that this Historic Period cultural boundary continued farther back, into the Woodland past.

Clearly, more work could be done on tying together the ceramics of southwestern Louisiana and Southeast Texas archeological sites.

### Lower Mississippi Valley, Marksville and Troyville

In the Lower Mississippi Valley, Marksville period sites were active between the years AD 100 and AD 400, during the Middle Woodland Period (McGimsey 2010). Unlike sites in Southeast and East Texas, Marksville period sites frequently

contain mounds, typically used for burials. The most important of these mound sites is the Marksville site, on a bluff overlooking an abandoned channel of the Mississippi. There are six earthen burial mounds within a 40-acre earth-ringed enclosure (location 3, Atlas V, Frame 6). Other sites of the time were mostly small village communities devoid of mounds. Ceramics are distinctive (Figure 11.20, lower row), and contain broad incisions and rocker-stamped motifs, sometimes including a striking bird motif not typical in Texas.

Troyville Culture is named for the Troyville mound complex, a group of seven mounds partly surrounded by an earthen ring (location 15, Frame 6). By this early part of the Late Woodland period, mound sites were becoming more ceremonial instead of being somewhat restricted to burials, as was the general case in previous times. Society was still basically egalitarian, and people seem still to have lived in small villages rather than in the large mound complexes. Many types of decorated Marksville ceramics continued into the time of the Troyville culture (Lee 2010).

Outside the LMV, mounds are rare at this time. The small Addicks Mound of western Harris County (location 1, Frame 6), begun during the time of the western expansion of Tchefuncte ceramics, contained Goose Creek ceramics in its upper portions (Black 1951; Wheat, 1953). The larger Coral Snake Mound on the Sabine River (location 2) was a burial mound with radiocarbon dates showing that it was active during Marksville (Middle Woodland) time and contained Marksville-type ceramics (McGimsey 2010; location 2, Frame 6). The Nearby Jonas Short site to the southwest (location 11) contains Goose Creek plain ceramics (Story 1990). The Marksville-type ceramics at the Coral Snake Mound and at several coastal sites shown on Figure 6 (discussed earlier) suggest a "buffer zone" between the LMV and Mossy Grove cultures.

### Lower Brazos Culture

The unique Lower Brazos Culture seems to have ended (or significantly changed) with the last burial in Burial Group 2 at the Witte site, at around AD 250. Younger burials are simpler and without grave goods, and there is little during this period to distinguish sites there from those of any other hunter-gatherers along the Texas Coast. People in this area at this time, however, adopted Goose Creek ceramic styles, which are found at many campsites of the period (Frame 6). Does this mean that Trinity-Sabine Tradition (now, Mossy Grove Culture) hunters were continuing to hunt seasonally in the San Bernard Prairie, leaving behind a few Goose Creek pots at their sites? Or did the people living between the Brazos and Colorado rivers take up the customs of pottery from their neighbors to the immediate northeast? Limited work on ceramic seriation in the Brazos Delta by Aten (1983) suggests that the protohistoric Coco living there adopted Goose Creek ceramics around AD 200, but Aten concedes that the area requires much more work, which still seems to be the general status there today.

### Fourche Maline

In the region of northeast Texas, northwestern Louisiana, and southeastern Oklahoma area (Red River and upper Sabine River valleys plus Ouachita Mountains; see

Atlas V, Frame 6), sites of this period continue to contain "Williams Plain" ceramics that, in contrast with those of the LMV, are plain and little decorated and are usually grog-tempered. Projectile points are typically of the Gary variety, and there are common double-bitted axes, which have been considered as evidence for early efforts at plant horticulture.

At the Tankersley Creek site (location 6, Frame 6), a multicomponent Archaic through Caddoan site, the bulk of the pottery found is of the Williams Plain variety, but there are a few sherds of Marksville from the LMV. A bit farther west at Hurricane Hill (location 5, Frame 6), in a plains area along a creek, there is evidence of the first arrival of a denser settlement of partly sedentary (seasonal) people in an area that had heretofore seen only roaming hunter-gatherers (Perttula 1999). They were not yet farming, although they were using the hoe-like double-bitted axes that suggest gardening of some sort—but not of maize, according to Perttula. They were using plain bowls and jars of local manufacture (Williams Plain), although the pots were not abundant. Just as at Tankersley Creek, archeologists found evidence of Marksville pottery from the Lower Mississippi Valley, evidence of the same sort of trade enjoyed at Tankersley Creek to the east. A speculation is that there was a rim of sorts around an expanding Fourche Maline cultural zone, where former areas of periodic bison hunting were being replaced by a more densely populated, partly sedentary culture.

In the upper Sabine area, three sites (Resch, Folly, and Haddens Bend; locations 8–10 of Frame 6) contain "Mossy Grove-type" ceramics, but with admixtures of bone and grog temper, more akin to Williams Plain; the area thus seems partly Mossy Grove and partly Fourche Maline (Story 1990:279). Again, it gives the impression that the Fourche Maline culture was beginning to expand to the south into the area of Mossy Grove or Trinity-Sabine Tradition territory, and that these three sites are in a sort of buffer zone along the expanding rim. This area later became part of the rapidly developing and growing Caddo tradition or material culture, as discussed in the next section.

## Late Prehistoric Period: Emergence of the Caddo

The Late Prehistoric Period of Southeast Texas (AD 600–AD 1700; Patterson 1996) is marked by the adoption of bow and arrow technology and corresponds approximately with the time of activity of the Coles Creek and Plaquemine-Mississippian cultures in the Lower Mississippi Valley (Atlas V, Frame 7a). It was a time of great change throughout the northwestern Gulf Coast region, and also a time when—at the period's end—it becomes possible to compare assumed archeological boundaries (areas of material cultures) with documented early Historic Period cultural group and linguistic boundaries.

### Trinity-Sabine (Mossy Grove)

In the area of Mossy Grove culture, untempered Goose Creek ceramics continued to be made in a similar fashion to before, but by about AD 950 in the Galveston Bay area (the early Round Lake Period of Figure 11.21), potters began to use "grog" as a temper. Grog consists of small pieces of broken pottery fragments, and its

addition to wet clay causes the clay to shrink and crack less in the drying stage. Ceramics that are otherwise similar to Goose Creek plain, but with the addition of grog, are known as Baytown Plain (formerly, San Jacinto Plain, as shown in Figure 11.21). Versions with incised rim decorations and containing grog are known as San Jacinto Incised (Aten 1983). In the project database that is based upon Patterson's work (1989a, 1989b), the two grog-tempered types are known as San Jacinto Plain and San Jacinto Incised, and they are displayed together in Frame 7b, which shows only the Southeast Texas project area. As can be seen, the San Jacinto and Goose Creek types are similar in distribution, suggesting that grog temper was an added technology rather than a cultural migration event.

During the Late Prehistoric, ceramic technology continued to spread in a southwestern direction along the coast to people of the proto-Karankawa culture, and to Central and South Texas to the various peoples who existed in the area of the Toyah Phase (Frame 7a). Ceramics became common in the central coast region by about 1000 AD, although small areas may have begun working with ceramics slightly earlier (Ricklis 2004). These ceramics, tied historically to the coastal Karankawa people (see, for example, the discussion of Alice Oliver's observations on Karankawa pottery making, Chapter 4), are in the form of Rockport ware, a distinctive form of sandy-paste pottery with asphaltum decoration (Ricklis 1995, 1996; see example sherds, Figure 8.40). The Karankawa lived along the coastal bays in this region, venturing inland a short distance to hunt.

### Central Coast and the Former Lower Brazos Culture (Coco)

An area of particular interest is in the area of the former Late Archaic Lower Brazos Culture. As mentioned in the previous section, ceramics arrived in the Lower Brazos delta about AD 200 in the form of Goose Creek pottery, and apparently spread into most parts of the Lower Brazos River and adjacent San Bernard Prairie, a noted hunting area frequented by a variety of cultural groups (see Chapter 7). By Late Prehistoric time, small amounts of Late Prehistoric asphaltum-decorated Rockport ware were found in several sites in association with older (Early Ceramic period) and also contemporaneous Goose Creek ware (e.g., Patterson et al. 1987; see Frames 7a and 7b). In the early Historic Period the general coastal area between the Brazos and the Colorado rivers was inhabited by the Coco, the northeasternmost band of the Karankawa (Bolton 1970 [1915]; Campbell 2019). As mentioned, the Coco spoke the Karankawan language but tended to live at Spanish missions with the Atakapans. It seems most reasonable that this small coastal area in Matagorda COunty was Coco—and hence, Karankawa—territory in the Late Prehistoric, but that Coco were at times on good terms with the adjacent Atakapans.

### Caddo (Former Fourche Maline)

A complex Caddo culture developed by about AD 800 featuring ceremonial mounds, maize agriculture, and a distinctive polished and engraved pottery and inhabiting a region in northeast Texas, northwest Louisiana, southeastern Oklahoma and southwestern Arkansas, along the Red and upper Sabine rivers (Girard 2010; Perttula 1992). It is typically thought that Caddo culture developed out of the

Fourche Maline culture in the same core area (Story 1990). The Crenshaw site in southwestern Arkansas (location 3, Atlas V, Frame 7a, upper center) is a ceremonial center containing older Fourche Maline burials (ca. AD 600–AD 900) that are overlain by early Caddo burials, dating from AD 1000 (Perttula and Story n.d.). Caddo culture had its zenith in the Late Prehistoric and early Historic periods. By the Early Ceramic period, formative Caddo people began to expand southwestward from Red River sites into the Sabine drainage basin, as mentioned. By Late Prehistoric time their southern margin moved southward again, displacing the northern boundary of former Mossy Grove (Trinity-Sabine Tradition) areas as shown by the yellow arrows in Frame 7a (compare earlier boundary, marked with dashes, with that shown in Frame 6). The George C. Davis and Deshazo sites along the upper Neches and Angelina rivers (locations 1 and 2, Frame 7a) contain Goose Creek ceramics stratigraphically beneath much more highly decorated Caddo ceramics (Story 1990; an example of Caddo pottery is shown in Figure 11.25). It is possible that the emergence of agriculture, ca. AD 1200, changed the balance of power between the Mossy Grove, proto-Atakapa culture and the Caddo, something that may have started when Fourche Maline people started using their double-bitted hoes a few centuries earlier (see preceding section). For whatever reason, the Caddo displaced southward the northern boundary of the long-standing Trinity-Sabine Tradition.

Figure 11.25. Caddo bowl, Natchitoches. The original is black with red incised lines. From Walker (1934).

A pertinent question is: did the proto-Atakapa of the Trinity-Sabine Tradition melt away in front of an advancing Caddo conquest, or did the earlier residents become Caddoans? We have insufficient data to answer that conclusively, but a few clues may be had by examining patterns of ceramics in the land occupied by the Bidai band of the early Historic Period (Atlas V, Frame 7b). A considerable amount of Caddo sherds are found mixed in with Goose Creek and San Jacinto sherds, suggesting another buffer zone, as at the Resch, Folly, and Haddens Bend sites mentioned in the previous section. Ethnohistoric data discussed in Chapter 4 show that the Bidai—a band of the Atakapa who spoke the Atakapan language—traded with the Caddo via the Bidai trail, which partly traversed Caddo territory. Many Bidai spoke Caddo as a second language, and they were experimenting with maize cultivation when their destiny was interrupted and cut short by disease during the eighteenth and early nineteenth centuries (Sjoberg 1951). Unlike the Akokisa, who appeared to fear the Hasinai Caddo of the Nacogdoches area (see Bellisle's story, Chapter 4), the Bidai of the Historical Period seem to have been at ease with their northern neighbor. This all suggests that the expanding southern boundary of Fourche Maline/Caddo culture was at least in part a matter of acculturation rather than conquest. From a Bidai perspective, there may have been something to be desired in a more settled, agricultural lifestyle, relative to the purely hunter-gatherer existence that was practiced by their Atakapa brethren.

It seems quite possible that the potential change in lifestyle simply drew converts, but a possible southward draw for the advancing Caddo was the access to rich deposits of silicified wood and ceramic-grade clay in the Neches-Angelina area, as discussed in Chapter 9.

### Central Texas Balcones Tradition

Inland from the Karankawa, various peoples of South and Central Texas lived in the area of the Toyah Phase (Frame 7a), a term for a "techno-complex" with a common set of lithic artifacts (typically related to use of Perdiz arrow points in bison hunting) and ceramics (Kenmotsu and Boyd 2012; Ricklis 1995). Ceramics typically consist of simple and undecorated bone-tempered bowls and jars, the so-called "Leon Plain" pottery of Suhm and Jelks (1962), that appeared rather abruptly in the archeological record. Many of the sites containing Leon Plain ceramics were hunting camps, where the short-term occupants used Leon Plain ware to help render grease from bison fat. The Mustang Branch site in the Balcones Escarpment area (location 5, Frame 7a) contained a large burned rock midden with remains of deer and bison as well as Scallorn arrow points indicating the arrival of bow and arrow technology at around AD 700. Pottery there is thought to have been used in grease extraction, as indicated by cracked bones that would have been boiled in the pots for that purpose (Ricklis and Collins 1994).

Because these were roaming hunters, not all of the Leon Plain ceramics are found within the (approximate) confines of the canyonlands refugium of the Central Texas Balcones Tradition. The Hinojosa site is such an outlier, inland some distance from the lower Nueces River and Corpus Christi Bay (location 4, Frame 7a). In addition to Leon Plain ceramics, it yielded marine shell artifacts and asphaltum from the coast, suggesting trade with the coastal Karankawa, who had their own Rockport pottery (Kenotsu and Boyd 2012). Another such outlier is site 41MM341 in Milam County (location 6), where sherds of two bone-tempered wares were found that were too thick for usual Leon Plain ware and were possibly made on site. Dated at from AD 1320 to 1480, they are from the latter part of the Toyah phase, made either by some roaming Toyah hunters with poor pottery skills or perhaps members of a different, unknown material culture (Perttula 2001).

An interesting side aspect of northeasternmost Toyah sites is the occurrence of intrusive Caddo pottery in otherwise clearly Toyah sites (Frame 7a). These exotic artifacts are considered as objects of trade by Kibler (2012), and along with the expansive distribution of Scallorn and Perdiz arrow points of the time (Chapter 7 and Atlas II), suggest broad intra-regional trade. Two sites of large trade fairs between Caddoan and South, Central and West Texas groups were recorded by Spanish visitors in the late seventeenth century (locations 3 and 4, Frame 9).

### Lower Mississippi Valley

East of Mossy Grove culture in the Lower Mississippi Valley, the period AD 600–AD 1700 is temporally correlative with LMV Late Woodland and Mississippian periods, which in the LMV contain the last century of Troyville (400–700 AD) as well as the entirety of Coles Creek (700–1200 AD) and Plaquemine (1200–1700

AD) material cultures. In each of these cultures, mounds were a significant part of the culture, in contrast to a seemingly mound-less Mossy Grove/Trinity-Sabine Tradition at this time.

During the time of the Coles Creek Culture, a transition began to more hierarchical societies, and its sites are known for large ceremonial centers where platform mounds were situated around plazas (Roe and Schilling 2010). Societies were more centered around the mound centers than around rural villages. Archeological results attest that people buried in mounds appear to be non-workers, and that elites seem to be fed higher grades of food (deer meat) than the general populace. An urban society was clearly emerging. Grave goods are scarce, and there is little evidence for much long-distance exchange. In contrast, ethnohistoric sources state that the mound-less societies that emerged in the early Historic Period within Atakapan Southeast Texas were essentially egalitarian, with no particular elite fraction beyond a shaman (e.g., Dyer 1917).

In Coles Creek cultures, the societies were still made up primarily of hunter-gatherers. The bow and arrow was introduced during the Troyville period and dominated hunting after about 700 AD (Lee 2010). Coles Creek ceramics are typically "hard, well-made, and tempered with grog" (Roe and Schilling 2010). Troyville (Baytown) and Coles Creek ceramics were similar in their plain-ness, and are considered essentially indistinguishable.

The setting of life in the Lower Mississippi Valley changed markedly during the Plaquemine phase (1200–1700 AD; Rees 2010b; Atlas V, Frame 7a). Population, already growing during the two previous periods, increased rapidly with the widespread adoption of agriculture, more or less coeval with the same technological change in Caddo country. Mounds became larger and more pyramidal in shape, as the elite fraction of society became more and more entrenched (Rees 2010b).

When considering all the cultures of the LMV periods, along with their Poverty Point antecedents, it is emblematic that mound cultures came and went, melting away into the surrounding forest after a particular mound site became no longer useful or liveable. The effects of that fractionation are apparent in the distributions of Early Historic Period ethnic groups that ethnologists have pieced together.

## Early Historic Period

At the end of Late Prehistoric time and the dawn of the Historic Period, when the first visiting Spanish and French soldiers and traders began to write about what they encountered along the northern Gulf Coast and its interior, a veil lifts and we can see each of these cultural regions of archeology—the Trinity-Sabine Tradition (Mossy Grove Culture), the Lower Mississippi Valley region, the Central Coast-South Texas Tradition/Aransas Focus area, and the modern Caddo region (Atlas V, Frame 7a)—as a setting of diverse ethnic groups that spoke a variety of languages (Frame 8, from Swanton's [1953]) ethnographic map, which depicts linguistic and ethnic groups in AD 1700).

Perhaps most surprising is the great ethnic diversity of the Lower Mississippi Valley region. The Plaquemine culture—successor to the Tchefuncte, Marksville, Troyville, and Coles Creek material cultures that preceded it—comprised a

series of rather urban ceremonial mounds and less prominent habitation sites. What emerged into history was not an ethnological common ground but a quilt of many different tribal and linguistic groups: Tunica groups, Natchez, Griga, Avoyel, Houma, Okelousas, Chitimacha, Chawasha, and others. In archeological space, they inhabited a more or less common technological or artifact culture, and most of them had adopted agriculture, but they were different peoples with different organizational affiliations and different languages (Rees 2010b). As Rees notes, this is perhaps not surprising, and he suggests that it was partially a result of the various separated mound-centered organizations of the past.

The Caddo cultural area—heir to the earlier Fourche Maline material culture—consisted in the early Historic Period of twenty-five "tribes" that formed three or more confederacies, including the Hasinai, Kadohadacho, and Natchitoches, which were linked linguistically (Swanton 1942, cited in Girard 2010). Girard notes that the "tribes" were linked by kinship, social and political ties. Like the people of the Plaquemine culture, they were agricultural mound builders, but unlike Plaquemine material culture they maintained dialects of a common Caddoan language over a wide area. The Caddo were successful and strong, and they expanded markedly along their southern border, either by conquest of or by peaceful acculturation to Caddo agricultural society of people within the existing Mossy Grove culture.

The Atakapa, who in the early Historic Period were makers and users of Goose Creek ceramics, were the people of the Mossy Grove culture—the last incarnation of the ancient Trinity-Sabine Tradition. Like the Caddo, they inhabited a very wide area but consisted of one ethnic group with one common language. Unlike Caddoan and Plaquemine cultures, they were generally not mound builders, and remained as non-sedentary hunter-gatherers rather than becoming agriculturalists. The Atakapa were subdivided into various bands, with each inhabiting a different coastal river, but they all spoke dialects of a common language (Swanton 1911). The various coastal rivers and their drainage basins within Atakapan territory were all tributaries of the ancient Ancestral Sabine River system in the now drowned Texas and Louisiana continental shelf (white dotted lines, Frame 8). As was discussed in Chapter 10, it seems plausible that the Atakapa had existed in this same Greater Sabine drainage basin since Paleoindian time, resulting in a language vastly different from any others spoken along its borders.

To the southwest of the Atakapa were the Karankawa of the Central Coast-South Texas Tradition. Their origins in deep prehistory are not fully understood, but by the Archaic there were pre-ceramic hunter-gatherers living on the central coast in what is called the Aransas Focus. As we have seen, Rockport ceramics were developed—probably out of Goose Creek antecedents along the Mossy Grove border—after AD 1000 in the Late Prehistoric Period (Ricklis 1996). Like the bands of the Atakapa, the Karankawan bands were ethnically similar and shared dialects of the same common language. Gatschet (1891) compared their language with those of all surrounding ethnic groups, and concluded that it, like Atakapa, was an isolate. They were commonly described as having a tall stature, unlike people of surrounding groups; their origin is obscure. Even more problematic are the Coco, the northeasternmost band of Karankawa speakers. They are here suspected of being the descendants of the people of the Lower Brazos Culture of Late Archaic and

Early Ceramic periods, but there is no current proof of that. The earlier people of the LBC were part of a long-distance exchange sphere that spanned much of North America, outstripping all of their direct neighbors in that trait.

The Toyah Phase (or Horizon or Culture, as it is variously described in archeological literature) has been considered as an aggregation of small, kin-based groups who shared a common culture. Ethnohistorical data, however, show that the Toyah geographical area in the early historic period was inhabited by numerous highly mobile hunter-gatherer groups, many of whom spoke different languages (Kenmotsu and Arnn 2012). Spanish explorers had names for dozens of small, often ethnically distinct bands—the Spanish typically called them "nations"—in this region. These ethnic groups of the early Historical Period are typically grouped by ethnologists like Swanton (1952) as the Coahuiltecans in South Texas and the Tonkawans in central Texas. The Tonkawa reflect a Historic Period amalgamation of earlier peoples in the area, some of whom were descendants of the various bands who inhabited the area in the Toyah phase, and others included peoples who fled into the region in advance of Apache migration from the north in the sixteenth and seventeenth centuries. Still other small groups amalgamated as a result of population losses from diseases spread by the Spanish intrusion into the area; these losses made some small ethnic groups no longer viable (La Vere 2004).

## Summary: Cultural and geographic continuity

Over the roughly 1800 years of Early Ceramic through Late Prehistoric periods, the Atakapans and their direct Mossy Grove predecessors in Southeast Texas maintained a certain constancy in lifestyle, activities, and language, one that was not particularly disrupted by the advent of new technologies like ceramics or the bow and arrow. One can theorize that that cultural stability could be pushed even farther back in time. Of the great longevity of the inland prairie hunting sites frequented by hunters of the Trinity-Sabine Tradition, Patterson (1985) had this to say, summarizing the findings at 41HR182, in western Harris County:

> *A stable nomadic hunting and gathering lifeway is indicated for the entire time period. A single type of lifeway and a stable settlement pattern continued from the Late Paleoindian period until European contact at the end of the Late Prehistoric. This is similar to the essentially stable lifeways that persisted for long time periods in the prehistoric of the Great Basin (Madsen and O'Connell 1982) and Iowa (Anderson and Semkin 1980), in spite of any possible climatic variations. . . . There is evidence for an "Archaic" hunting and gathering lifeway at even the earliest known sites in this region.*

The common language of their bands, each of which inhabited a tributary of what in the Paleoindian Period was a common Sabine River (Frame 8), supports the notion that their language isolate grew in local isolation. Their ecological habitat was not one like the Mississippi River Valley, with tributary tentacles reaching deep into many corners of interior North America, but the cultural habitat was no doubt shaped by the relatively small drainage basins of the Sabine-Neches system and of its former tributaries, the Trinity, San Jacinto, Calcasieu, and Mermentau rivers, which lacked any riverine connection to the cultures of the Upper Mississippi and Ohio

river valleys. The Atakapa shared a common habitat of relatively small, languorous rivers and associated backwater creeks and bayous, where catfish, turtles, and alligators were within reach, and deer and bison were not too far for an organized hunt. It was a specialized existence in a humid, mosquito-plagued environment that was probably not suited to everyone in that time. For whatever reason, they seem to have been left more or less alone for millennia.

If the ancestors of the Atakapa had indeed lived in this Trinity-Sabine river country since Paleoindian time, then they faced rising sea level along the coast for thousands of years, losing nearly a quarter of their supposed original territory to the sea (Chapter 10). That loss of land seems to reverberate in creation myths that some of the few remaining Atakapans in the Historic Period relayed to visitors:

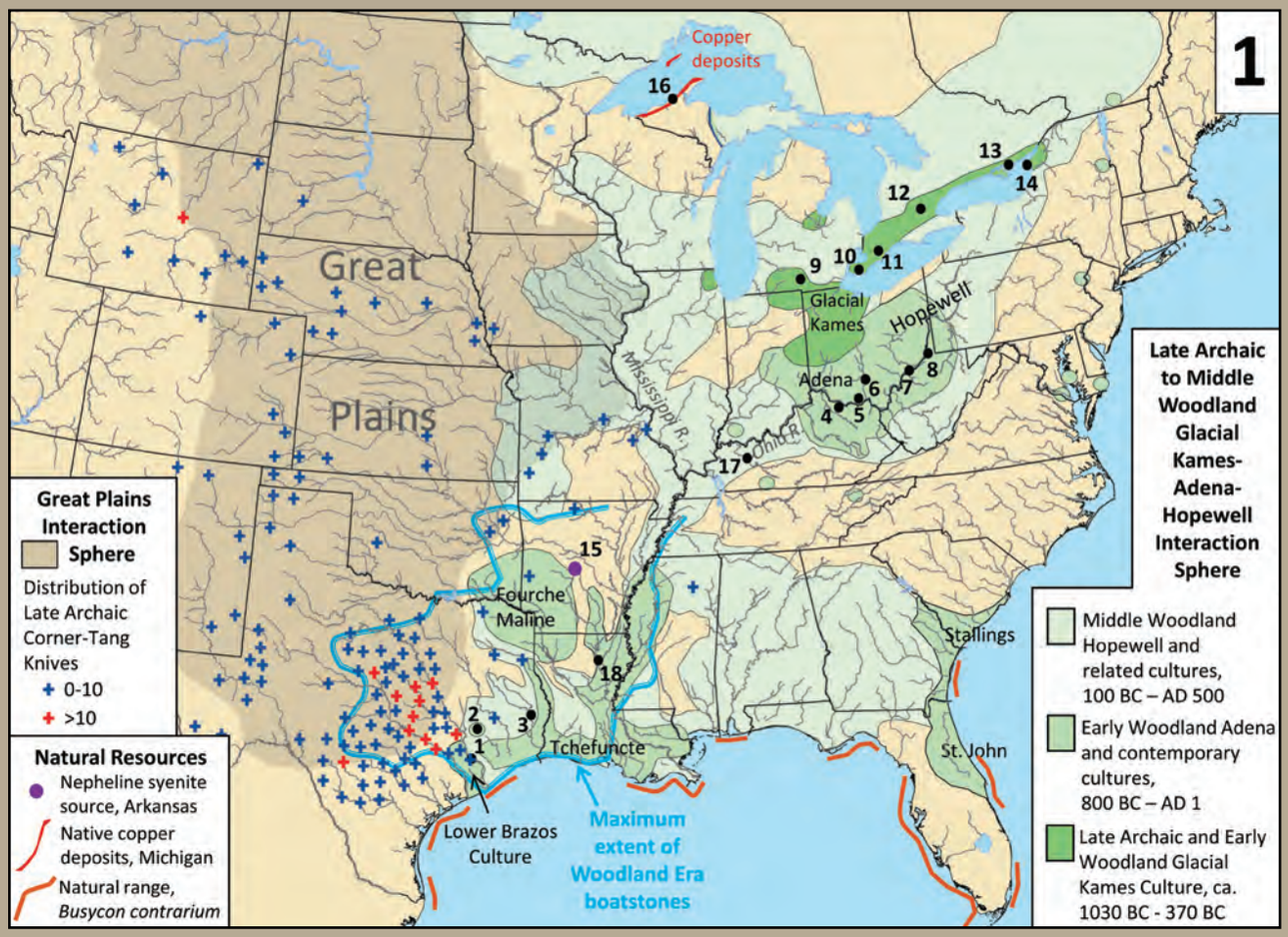
> *They came out of the sea, being cast up in large oyster shells, from which the first men grew.* (Dyer 1917)

> *A large flood "swallowed up men, animals, and the land, and it was only those who resided along a high land or mountain who escaped this calamity.* (Martin Duralde's notes of 1802, as quoted by Swanton, 1911)

Perhaps the Atakapa had a lingering cultural memory of the rise in sea level that consumed much of their land. But their largest territorial losses came in their northern area, where Caddoans—who possessed the great advantage of agriculture—rapidly expanded during Late Prehistoric time into what had once been lands of the Trinity-Sabine culture. That process, as suggested by Story (1990), was not necessarily a violent one, and indeed the Bidai of the Historic Period may well have been acculturating to Caddo lifestyles when all of these groups were lost, or very nearly so, to epidemic diseases and colonial subjugation.

# Atlas V

# Cultural and technological development of Southeast Texas, Late Archaic through Early Historic periods



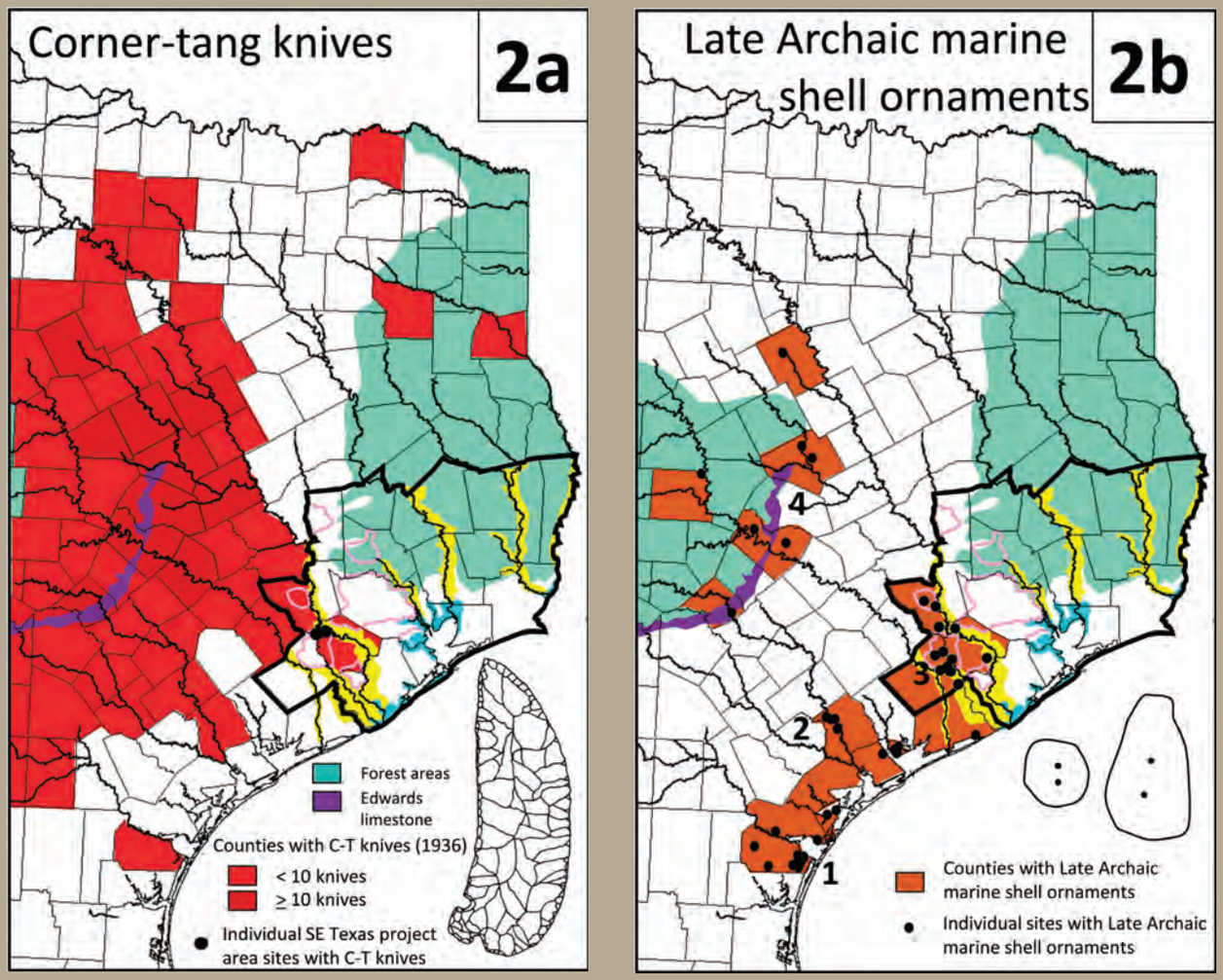

Frame 1. Cultural aspects of eastern and central North America during the Early and Middle Woodland periods, 800 BC–AD 400. Eastern area: Late Archaic to Middle Woodland Glacial Kames-Adena-Hopewell interaction sphere. Western area: Great Plains interaction sphere.

Eastern area compiled from a map by Dale Brown (1992), a map compiled by Herb Roe (2008, Wikimedia Commons), and from this report. Distribution of corner-tang knives from Patterson (1937). Sources of boatstone locations shown in Frame 3.

Locations mentioned in text:
1. Bowser site (41FB03), Fort Bend County, Texas
2. Dimond Knoll (41HR796), Harris County, Texas
3. Jonas Short site (41SA101), San Augustine County, Texas
4. Fox Farm mounds, Mason County, Kentucky
5. Tremper Mound, Scioto County, Ohio
6. Caldwell Mound and Mound City, Ross County, Ohio
7. Conus (Marietta) Mound, Marietta, Washington County, Ohio
8. Adena Mound at Natrium, Marshall County, West Virginia
9. Burch site, Glacial Kames culture, Branch County, Michigan
10. Sartori site, Glacial Kames culture, Ontario
11. Zimmer and Hind sites, Glacial Kames culture, Ontario
12. Schweitzer site, Glacial Kames culture, Ontario
13. Trenton Mountain site, Glacial Kames culture, Ontario
14. Pictin site, Glacial Kames culture, Ontario

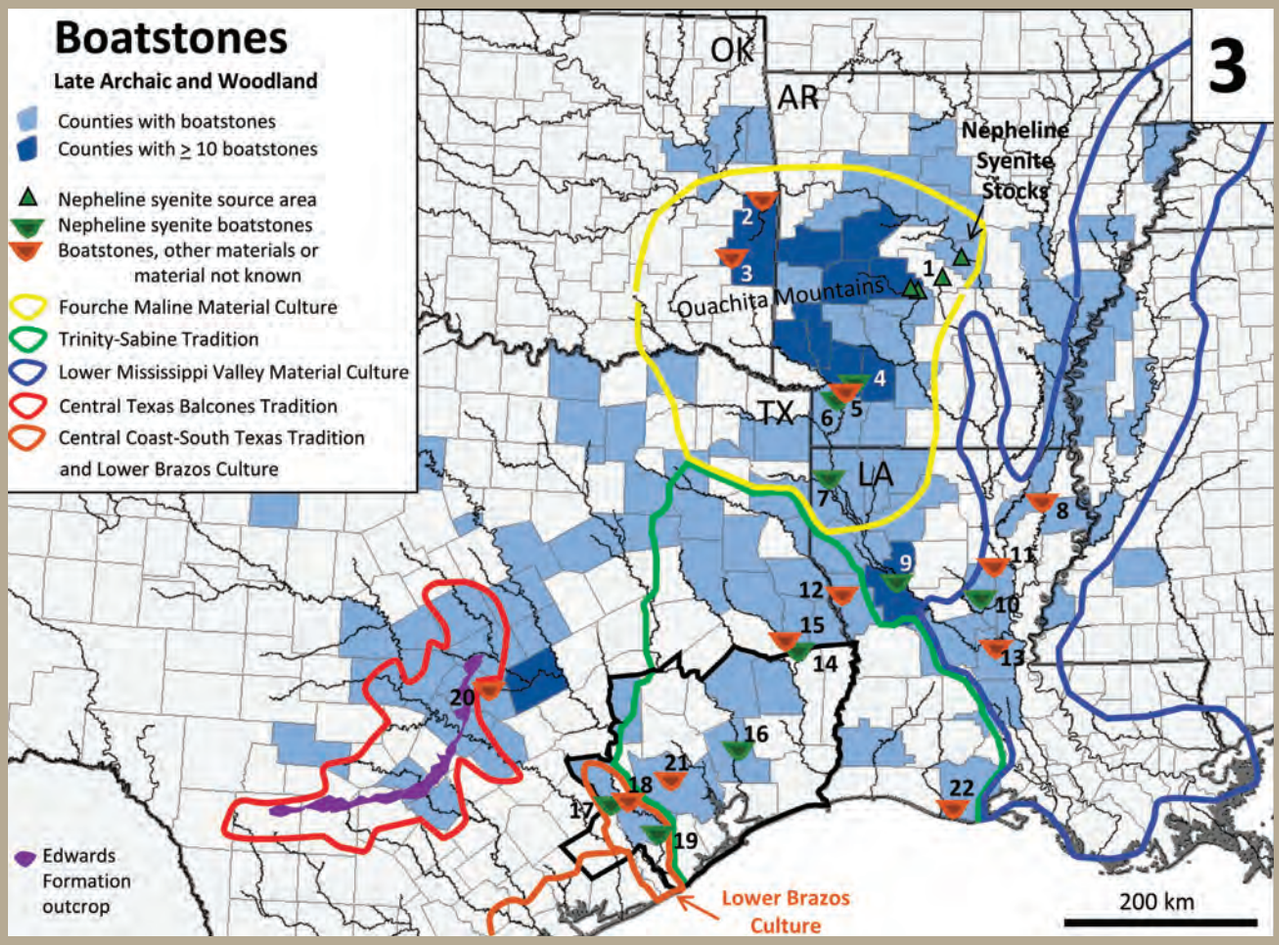
Geologic resources:
15. Nepheline syenite igneous stocks exploited by Native American stoneworkers, Arkansas
16. Native copper deposits exploited by Archaic people, Keewenaw Peninsula and Isle Royale

Middle Archaic precursor sites:
17. Indian Mound site, Kentucky
18. Watson Brake mound complex, Louisiana



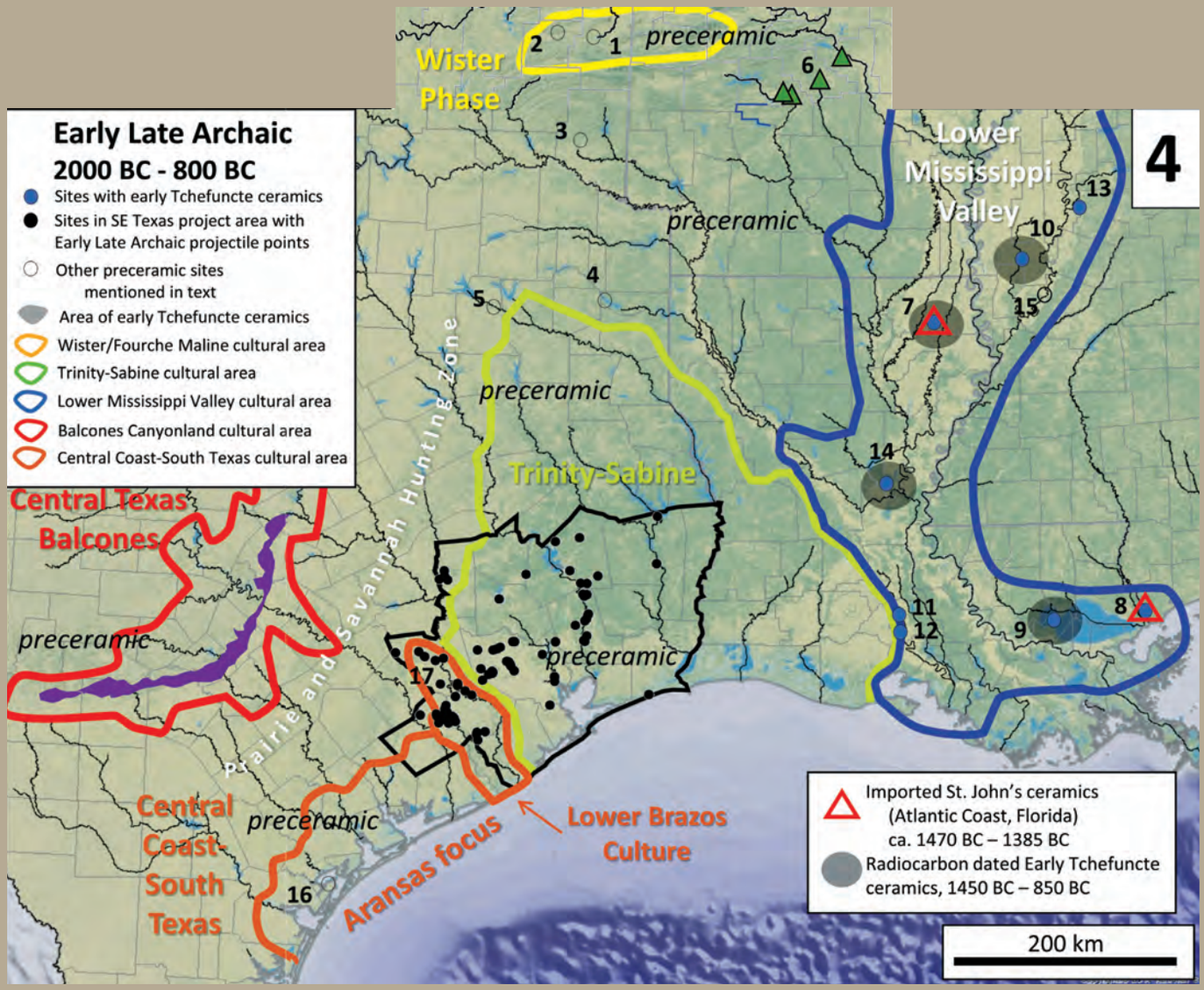

Frame 2a. Distribution map of Late Archaic corner-tang knives, eastern and central Texas. County distribution (red shading) from J.T. Patterson (1936 and 1937b), to which has been added information from Fort Bend, Victoria, and Karnes counties (multiple sources mentioned in text).

Frame 2b. Sites with Late Archaic (or probable Late Archaic) marine shell ornaments. Sites within the project area include burial sites 41AU1, 41AU36, 41AU37, 41AU55, 41WH14, 41WH39, 41WH44. Other sites within project area with marine shell ornaments include: 41MG23, 41MG050, 41MG052, 41FB003, 41FB002, 41FB013, 41WH032, 41WH080, 41WH083. Ornaments in all other areas are from Hall (1981:219). Note: A site noted by Hall (1981) as containing marine shell ornaments in Harris County, 41HR61, was later reported to contain only a few freshwater mussels that had been notched, perhaps as tools (Ring, 1994).



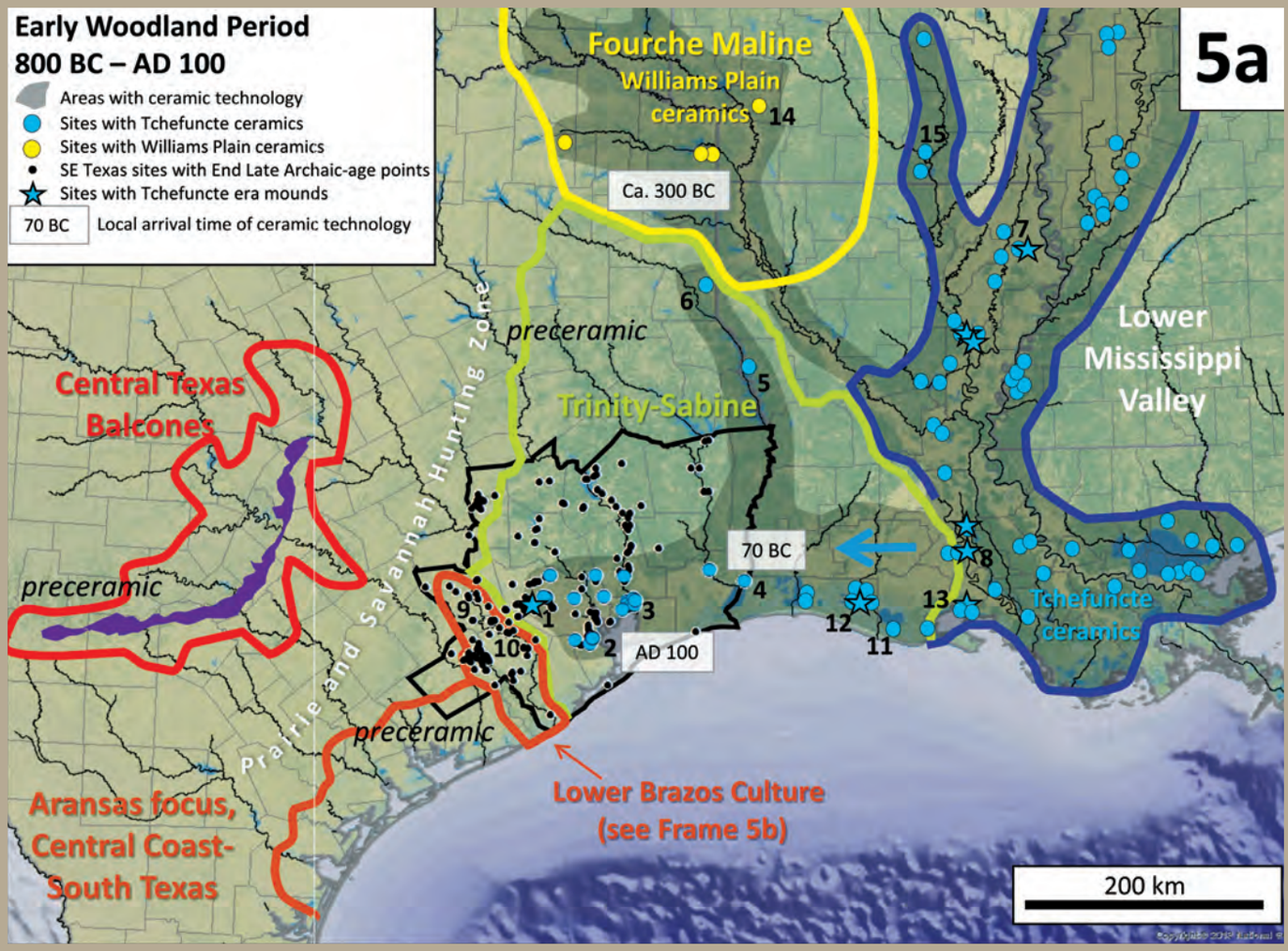

Frame 3. Distribution of boatstones, Late Archaic and Early Ceramic (Early and Middle Woodland) periods. Counties with boatstones (blue shading) from a map by J. T. Patterson (1937), with a few counties added since Patterson's work, including Harris, Austin, Fort Bend, Liberty and San Augus-tine counties, Texas, and Vermilion Parish, Louisiana. Explanation of selected individual sites:

1. Four small nepheline syenite igneous intrusives, Magnet Cove, Garland, Saline and Pulaski Counties, Arkansas. These are small alkalic intrusive bodies of Cretaceous age, each around 4 km in diameter or less, and are associated with dikes and sills of trachyite, phonolite and diabase (Haley, 1993). These intrusives constitute the source of all nepheline syenite in the continental U.S. and are the type locale for a number of rare mineral species (Erickson and Blade, 1963). They are also the probable source for other intermediate igneous boatstones on this list, including those termed diabase, greenstone, and diabase or greenstone porphyry.
2. Six boatstones at Craig's Mound in Spiro Mound Complex. Two excavated in context were from early stage considered end Woodland (Fourche Ma-line); the other four are non-dated and are composed of green porphyritic igneous rock (Sievert, 2011), probably from Magnet Cove.
3. Boatstones, mostly sandstone, in Wister Valley, Oklahoma, from the pre-ceramic Wister Period, which is time correlative with the Poverty Point and Tchefuncte cultures of LMV (Galm, 1984; Patterson, 1937a; Rowe, 2014).
4. Syenite boatstone, Hope, Hempstead County, Arkansas (Patterson, 1937)
5. Boatstone, unknown composition, Shane site, probably Fourche Maline material culture time-correlative with Marksville Period (Story, 1990)
6. Two boatstones, Fourche Maline material culture, Crenshaw site, Miller County Arkansas. Diabase and trachyte compositions, probably from Magnet Cove source (Perttula et al, 2013).
7. Syenite boatstone, Caddo Parish Louisiana (Patterson, 1937a).
8. Three boatstones, unrecorded lithology, Poverty Point site, Louisiana, (Webb, 1968).
9. Syenite boatstone, Natchitoches, Louisiana (Patterson, 1937a)
10. Syenite boatstone, La Salle Parish, Louisiana (Patterson, 1937a)
11. Boatstone, unknown composition, Crooks site, Marksville Period (Story, 1990)
12. Boatstone, unknown composition, Coral Snake Mound (Story, 1990)
13. Boatstone, quartzite, Coles Creek Period; and boatstone, diorite porphyry, Troyville: Greenhouse site, 16AV2, probably Troyville Period (Fairbanks, 1956; Ford, 1951)
14. Two nepheline syenite boatstones, Jonas Short Mound, 41SA101 (Story, 1990)
15. Boatstone, unknown composition, Wolfshead site, Late Archaic or Mossy Grove Cultural Period (Story, 1990)
16. Boatstone, fine grained limestone (exotic to locality), Savoy site, 41LB27 (Crook, 2019a)
17. Nepheline syenite boatstone and two other boatstones, Witte site, 41AU37 (Hall, 1981)
18. Five sandstone boatstones of local origin, Bowser site, 41FB03 (Patterson et al,, 1999; see Chapter 11)
19. Nepheline syenite boatstone, Albert George site, 41FB13 (Walley, 1955)
20. Boatstone, local limestone, Granger Reservoir area (Prewitt, 1981b)
21. Boatstone, sandstone, Alabonson Road site, 41HR273 (Ensor and Carlson, 1991)
22. Boatstone, Late Archaic (pre-Tchefuncte) Copell burial site, Vermillion Parish (Ford and Quimby, 1945; Gagliano, 1977)


Early Late Archaic
2000 BC - 800 BC
Sites with early Tchefuncte ceramics
Sites in SE Texas project area with Early Late Archaic projectile points
Other preceramic sites mentioned in text
Area of early Tchefuncte ceramics
Wister/Fourche Maline cultural area
Trinity-Sabine cultural area
Lower Mississippi Valley cultural area
Balcones Canyonland cultural area
Central Coast-South Texas cultural area
4
Wister Phase
preceramic
Lower Mississippi Valley
Trinity-Sabine
Central Texas Balcones
Prairie and Savannah Hunting Zone
Central Coast-South Texas
Aransas focus
Lower Brazos Culture
Imported St. John's ceramics (Atlantic Coast, Florida) ca. 1470 BC – 1385 BC
Radiocarbon dated Early Tchefuncte ceramics, 1450 BC – 850 BC
200 km

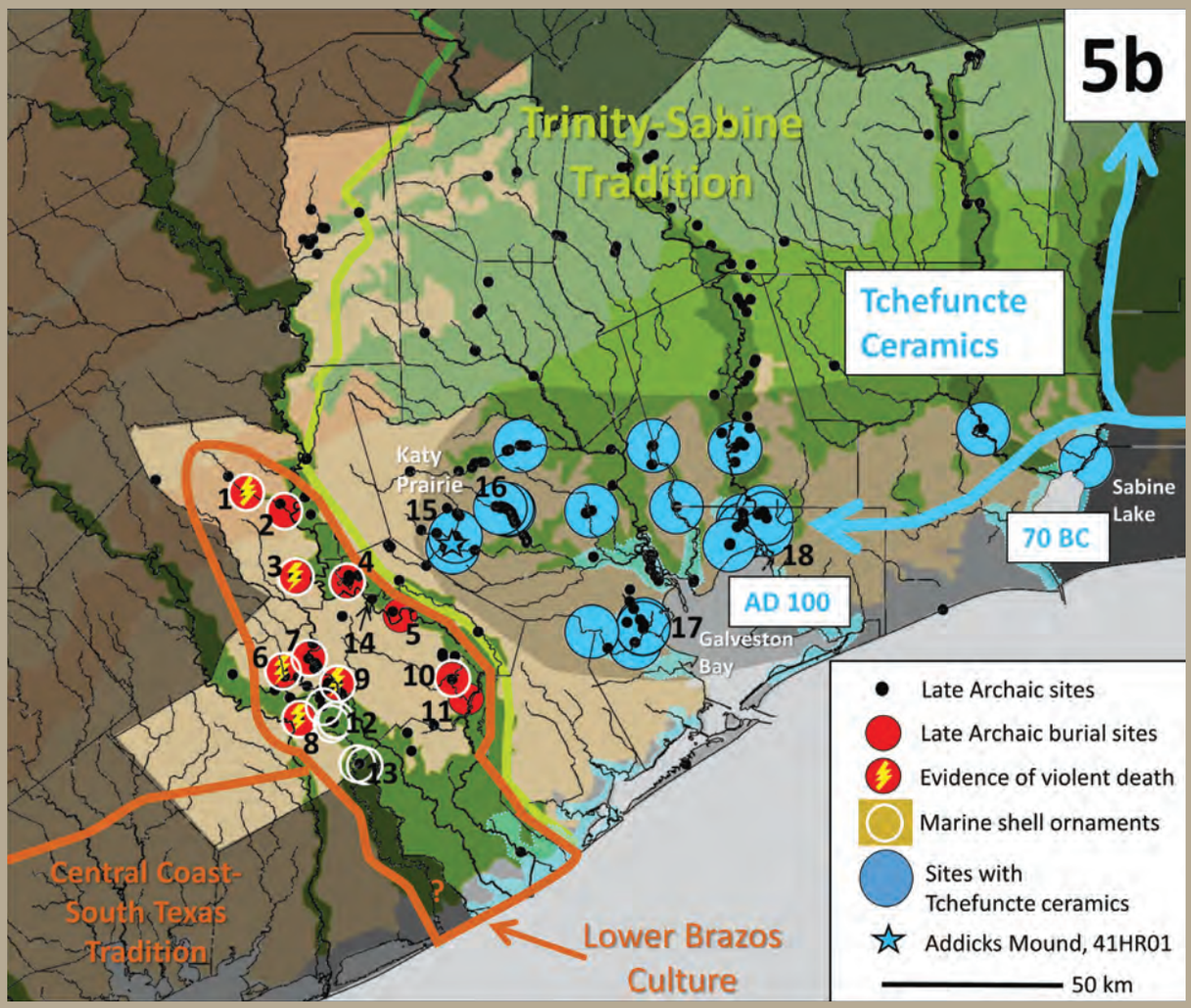
Frame 4. Western Gulf Coast cultural areas during the early Late Archaic Period. Poverty Point-era sites of the Lower Mississippi Valley are from Webb 1968. Sites depicted with Early Tchefuncte (1450 BC – 850 BC) ceramics (blue dots) are from Hays and Weinstein (2004) and Gibson and Melancon (2004). Sites mentioned in text:

1. Wister Valley sites, Oklahoma (Rowe 2014; Schambach 1982)
2. Bug Hill site, 34Pu-116
3. Bell site, Oklahoma (Story, 1990)
4. Jake Martin site, 41UR 12
5. Yarbrough site, 41VN6
6. Area of nepheline syenite igneous stocks
7. Poverty Point, 16WC5
8. Claiborne, 22HA501
9. Bayou Jasmine, 16SJB2
10. Jaketown, 22HU505
11. Meche-Wilkes, 16SL18
12. Ruth Canal, 16SM20
13. Teoc Creek, 16CR504
14. Cross Bayou, 16CT365
15. Slate site, Humphreys County, Mississippi
16. Kent-Crane site, 41AS3
17. Witte, 41AU36, and Bowser, 41FB3 sites. See Frame 5b for greater location detail.




Frame 5a. Western Gulf Coast cultural areas at the end of the Late Archaic through Early Woodland periods, when Tchefuncte ceramics began to spread westward from the Lower Mississippi Valley. Lower Mississippi Valley sites from Toth (1988); Arkansas sites from Jeter and Early (1999); Ancestral Atakapa sites from Patterson-HAS database (this report). Circles in blue refer to sites with Tchefuncte ceramics; blue stars locate Tchefuncte-era burial mounds (after Hays and Weinstein 2010). Key to numbered sites:

1. Addicks Mound, 41HR001
2. Clear Lake area sites
3. Upper Galveston Bay and Trinity estuary sites
4. Sabine Lake area
5. Coral Snake Mound, 16SA48
6. Resch site, 41HS16
7. Poverty Point, 16WC5 (for location only; not Tchefuncte associated)
8. Lafayette Mounds, 16SM17
9. Witte, 41AU036, and Bowser, 41FB03
10. Albert George, 41FB013
11. Copley burial site, pre-ceramic Late Archaic but no precise date (Gagliano 1977; Ford and Quimby 1945).
12. Alligator Mound (now destroyed shell mound), Chenier du Fond (McIntire 1954)
13. Morton Shell Mound, Iberia Parish (McIntire 1954; Byrd 1976, 1994)
14. Johnny Ford site, burial mound (Schambach, 1982)
15. Tchefuncte sites at the intersection of the Saline and Ouachita rivers (Jeter and Early 1999).



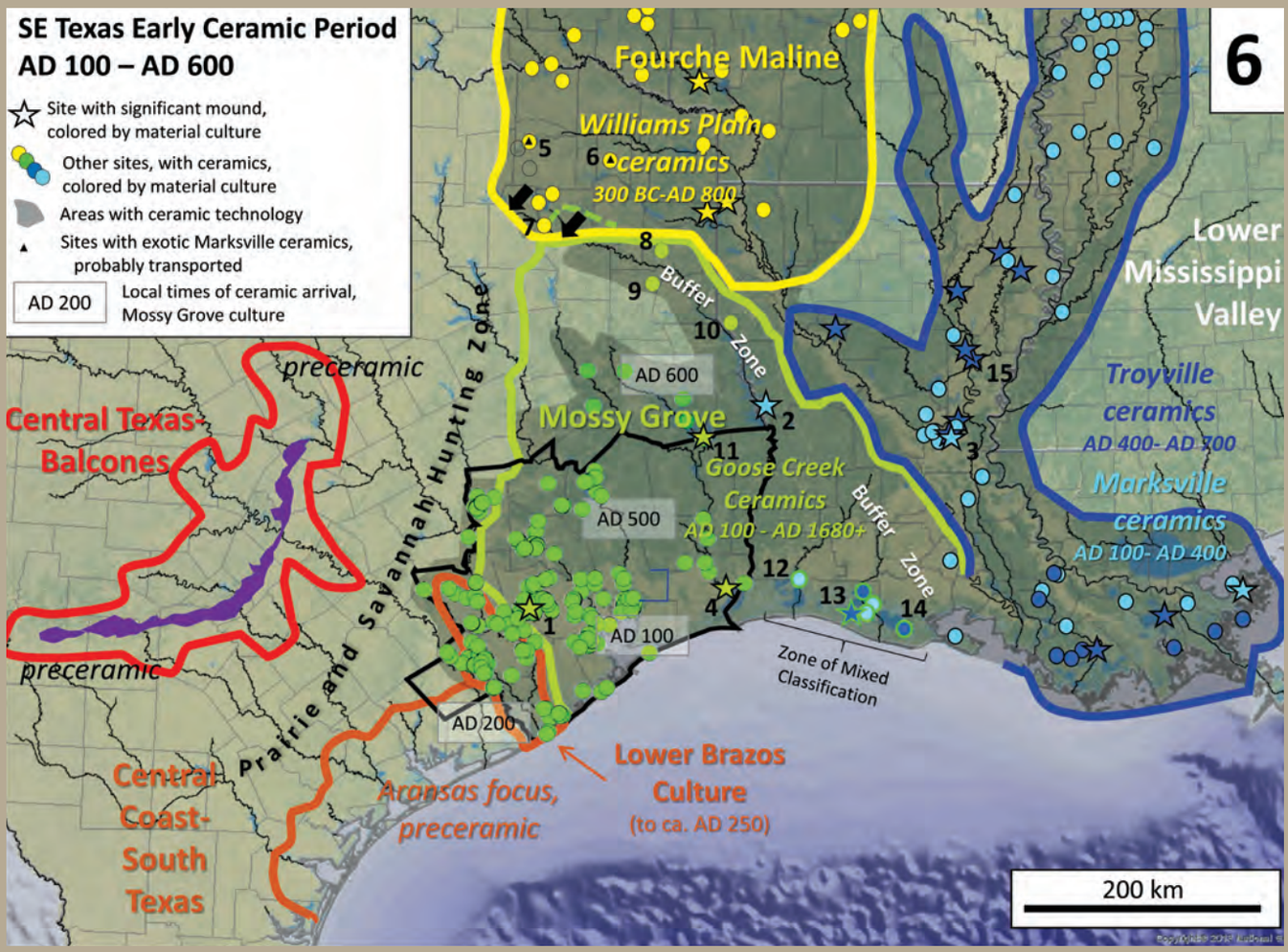

Frame 5b. Southeast Texas areas at the end of the Late Archaic through Early Woodland periods (an enlargement of a part of Frame 5a).

Sites of the Late Archaic Lower Brazos Culture:
1. Goebel, 41AU001 (Story 1990)
2. Brandes, 41AU055 (Story 1990)
3. Ernest Witte, 41AU037, and Leonard K, 41AU36 (Hall 1981)
4. Bowser, 41FB003 (Patterson et al. 1999)
5. 41FB250 (Patterson 1997a, 2000)
6. Piekert, 41WH014 (Hudgins and Kindall 1984)
7. 41WH044 (Black et al. 1992)
8. Crestmont, 41WH039 (Vernon 1989; Story 1992)
9. Ferguson, 41FB042 (Patterson et al. 1993a)
10. Albert George, 41FB013 (Walley, 1955)
11. Big Creek, 41FB002 (Story 1990; TARL archives)

Non-burial sites with marine shell ornaments:
12. Three sites (WH080, WH032, WH083)
13. Two sites (MG050, MG052)

Hunting site:
14. Joe Davis site, FB223 (Patterson et al. 1994)

Tchefuncte sites mentioned in text:
15. Addicks Mound, 41HR01, and Kobs site, 41HR07 (Black 1951, n.d.; Wheat 1953)
16. Alabonson Road, 41HR273 (Ensor and Carlson 1991)
17. Clear Lake area sites (Aten 1983)
18. Upper Galveston Bay and Trinity estuary sites (Aten 1983)



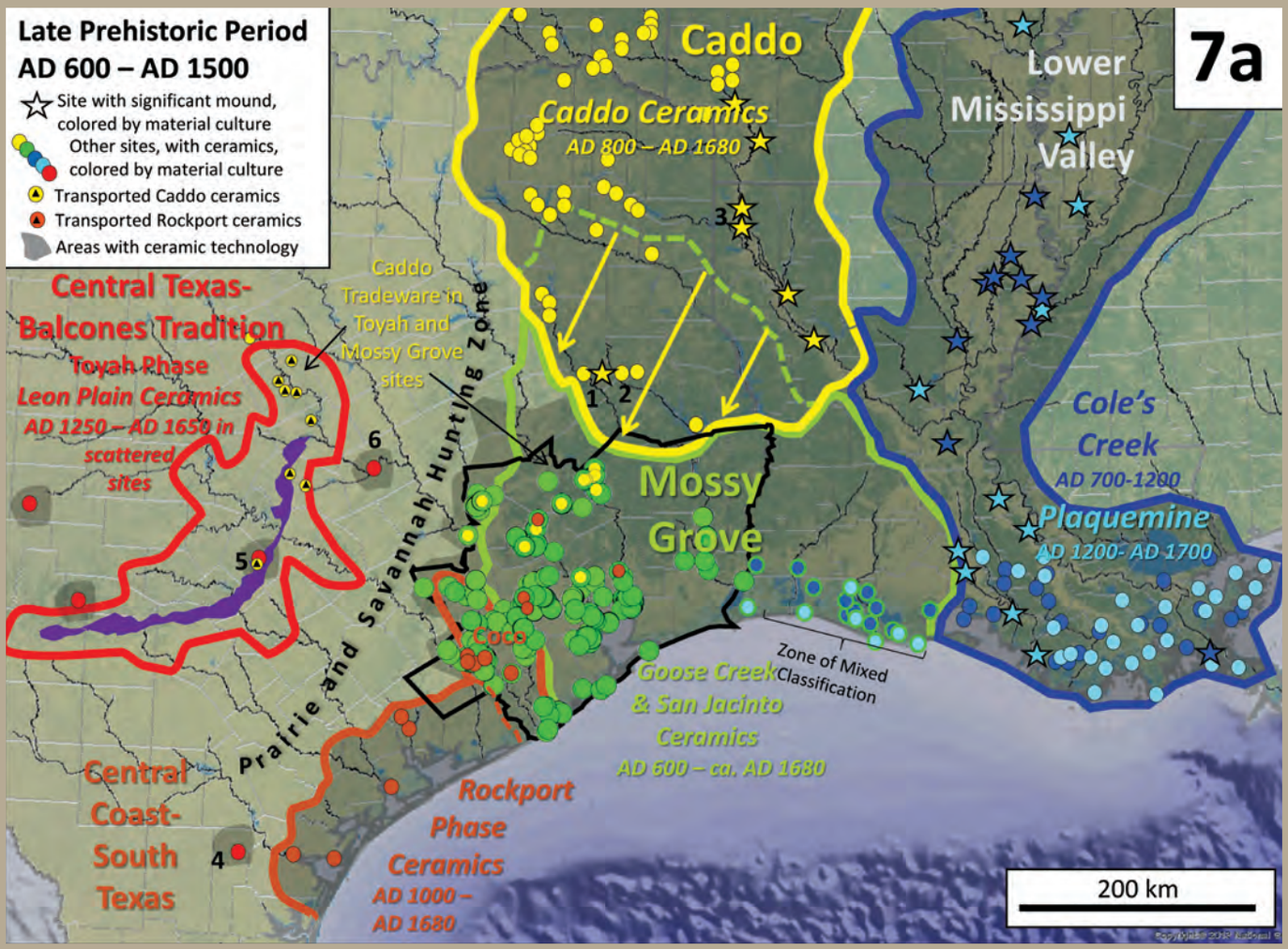

Frame 6. Western Gulf Coast cultural areas during the Southeast Texas Early Ceramic Period (Middle Woodland and beginning of Late Woodland periods). Dots represent sites with ceramics of this age (100–600 AD). Key to numbered sites:

1. Addicks Mound, 41HR001
2. Coral Snake Mound, 16SA48
3. Marksville mound complex, 16AV1
4. former cluster of large mounds at Port Neches, now destroyed (Block 1976, 1977)
5. Hurricane Hill, 41HP106
6. Tankersley Creek, 41TT108
7. Yarbrough, 41VN6
8. Resch, 41HS16
9. Folly, 41RK26
10. Haddens Bend, Louisiana, X16DS4
11. Jonas Short mound, 41SA101

12, 13, 14. Sites at or near Calcasieu, Grand, and White lakes have ceramics designated as Marksville and Troyville by McIntire (1954), showing LMV influence. Eastern border of "Mossy Grove" ceramics in Louisiana has not been determined for the coastal zone, hence green borders to site symbols, showing uncertainty of affiliation (or presence of a gradual shift). Little Chenier mound complex marked by star at 13.

15. The Troyville mound complex

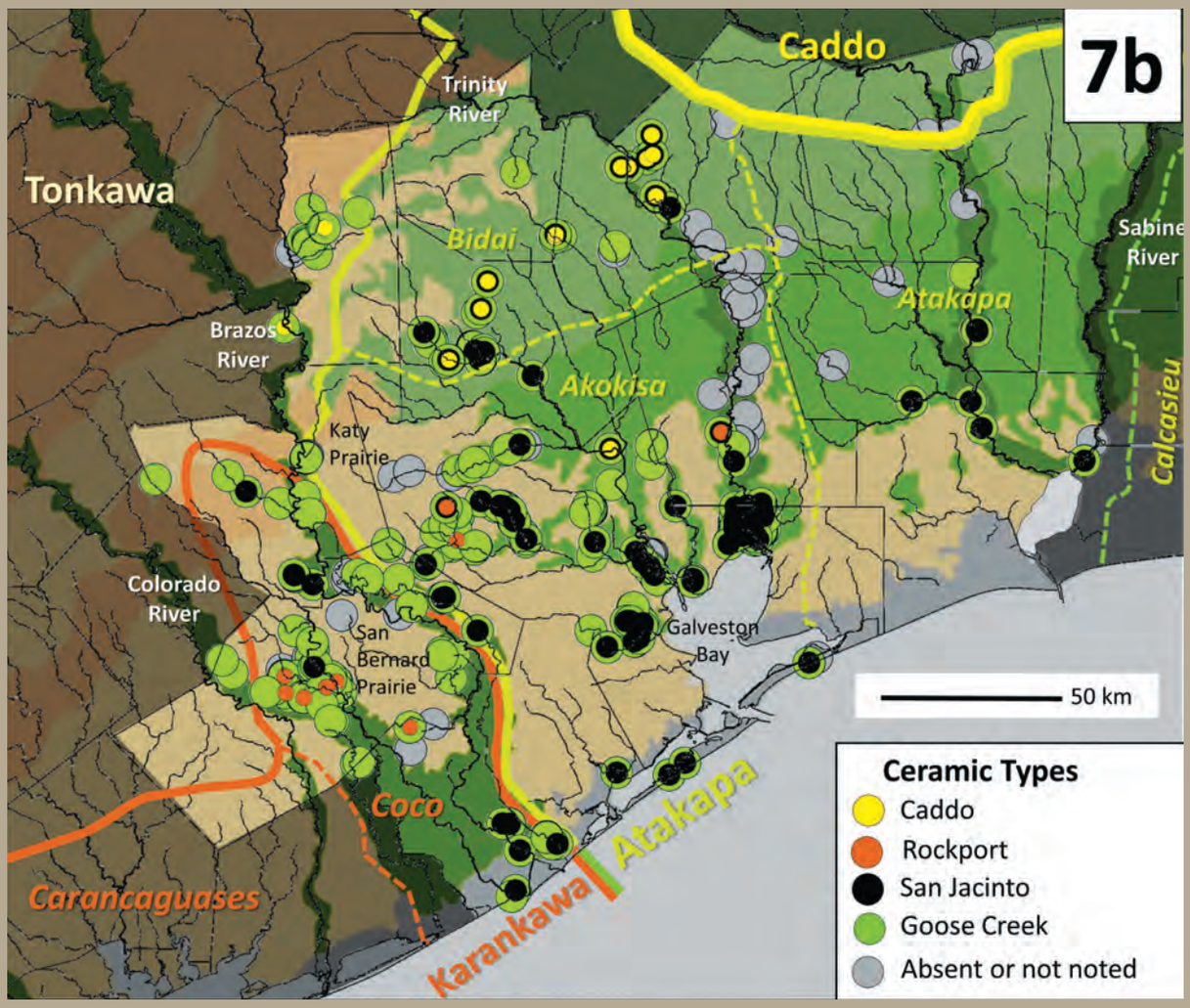
Lower Mississippi Valley and delta Marksville sites from Toth (1988), with significant Marksville mound sites from McGimsey (2010), and coastal sites from McIntire (1954). LMV Troyville sites from Lee (2010) with coastal sites from McIntire (1954); Ancestral Caddo sites from Story (1990); Ancestral Atakapa (Mossy Grove) sites from Patterson-HAS database and from Story (1990); Karankawa pre-ceramic sites from Ricklis (2004). No site details were available for Louisiana sites within modern day Atakapa range (southwestern Louisiana).



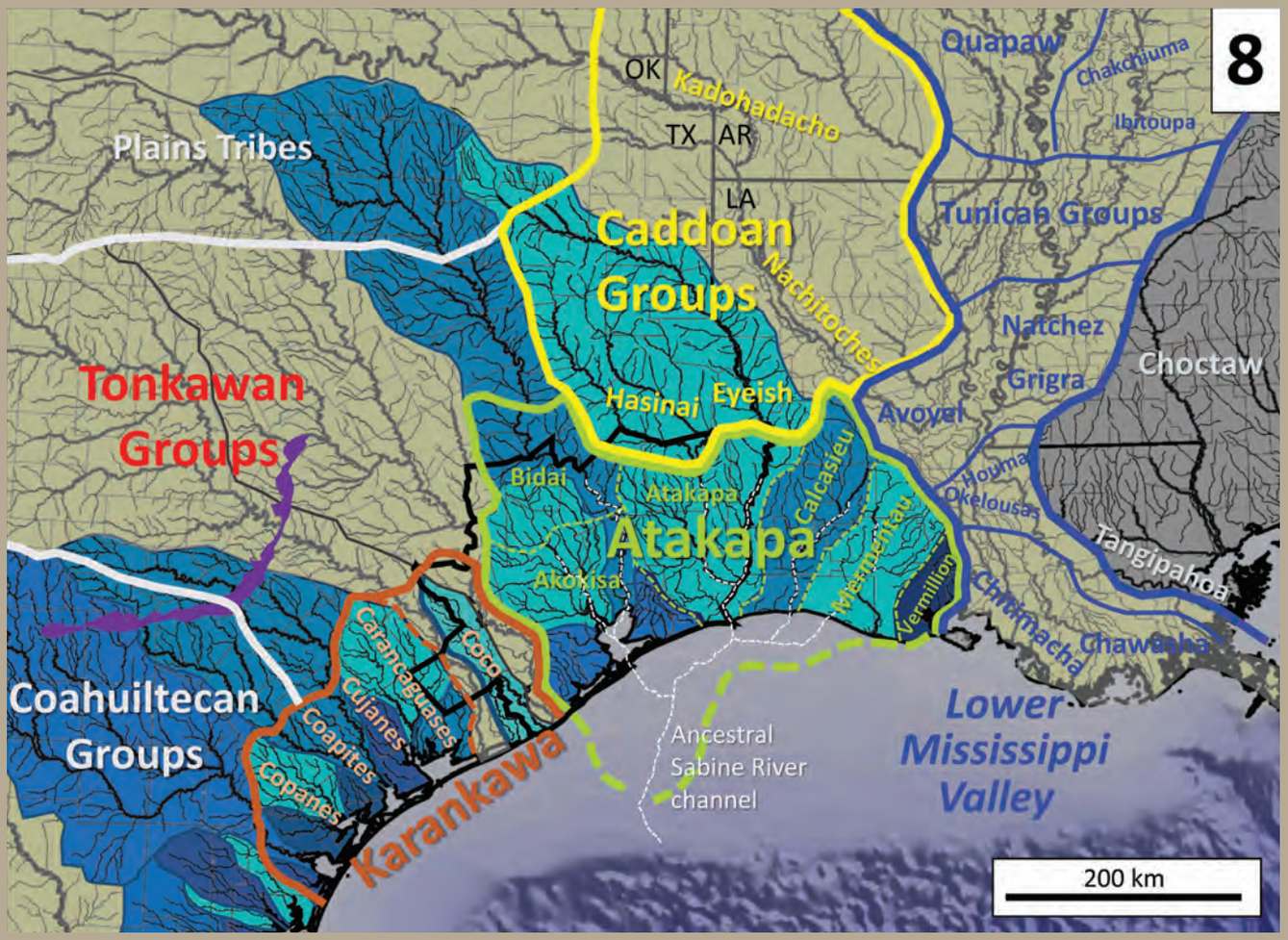

Frame 7a. Western Gulf Coast cultural areas during the Late Prehistoric Period (Late Woodland through Mississippian periods). Dots represent sites with ceramics within this age (600–1500 AD). Locations mentioned in text:

1. George C. Davis, 41CE19
2. Deshazo, 41NA27
3. Crenshaw, Miller County, Arkansas
4. Hinojosa, 41JW8
5. Mustang Branch, 41HY209; Ricklis and Collins, 1994
6. Milam County site, 41MM341

Lower Mississippi Valley: Coles Creek significant mound sites from Roe and Schilling (2010), and Plaquemines significant mound sites from Rees (2010). Coastal and Mississippi delta sites from McIntire (1954). Caddo sites from Story (1990) and mound locations from Girard (2010); Late Prehistoric sites with Goose Creek ceramics from Patterson-HAS database (this report); Rockport ceramic sites from Ricklis (2004).




Frame 7b. Geographic distribution of post-Tchefuncte styles of ceramics in Southeast Texas archeological sites (ca. AD 100+ to ca. AD 1800). Heavy lines show boundaries of cultural groups (tribes) from the early Historic Period (ca. 1700), modified from Swanton 1952. Dashed lines show inferred boundaries of bands.




Frame 8 (above). Major Native American cultural groups, ca. 1700, from Swanton (1911, 1952). Cultural boundaries are superimposed upon a base map of major and minor river drainage basins, as shown and discussed in Figure 1.2 (where individual river basins are named). Purple area represents the outcrop zone of the Edwards Formation. White dashed line represents the offshore location of the flooded portions of the Sabine-Trinity river system and its branches (see Chapter 10). The now-offshore portion of the drainage basin boundary of the Sabine-Trinity river system during the Paleoindian period is marked by a heavy green dashed line.

Frame 9 (next page). Major Native American Trails of the Early Historic Period, ca. 1700. Known Native American trails (not Spanish roads) are shown in red, and major cultural groups of that same era are named, from Swanton (1911), as per Frame 10.

1, 2. Native American trails documented in Spanish accounts leading from Coahuila, and from there, south to central Mexico (Foster 1995:2). Their entry route southwest of San Antonio varied slightly from that of the later Spanish-built El Camino Real (road to San Antonio and Nacogdoches; see 5), used later by multiple Spanish expeditions, but the Camino Real follows the older trail 1 northeast of site 3.

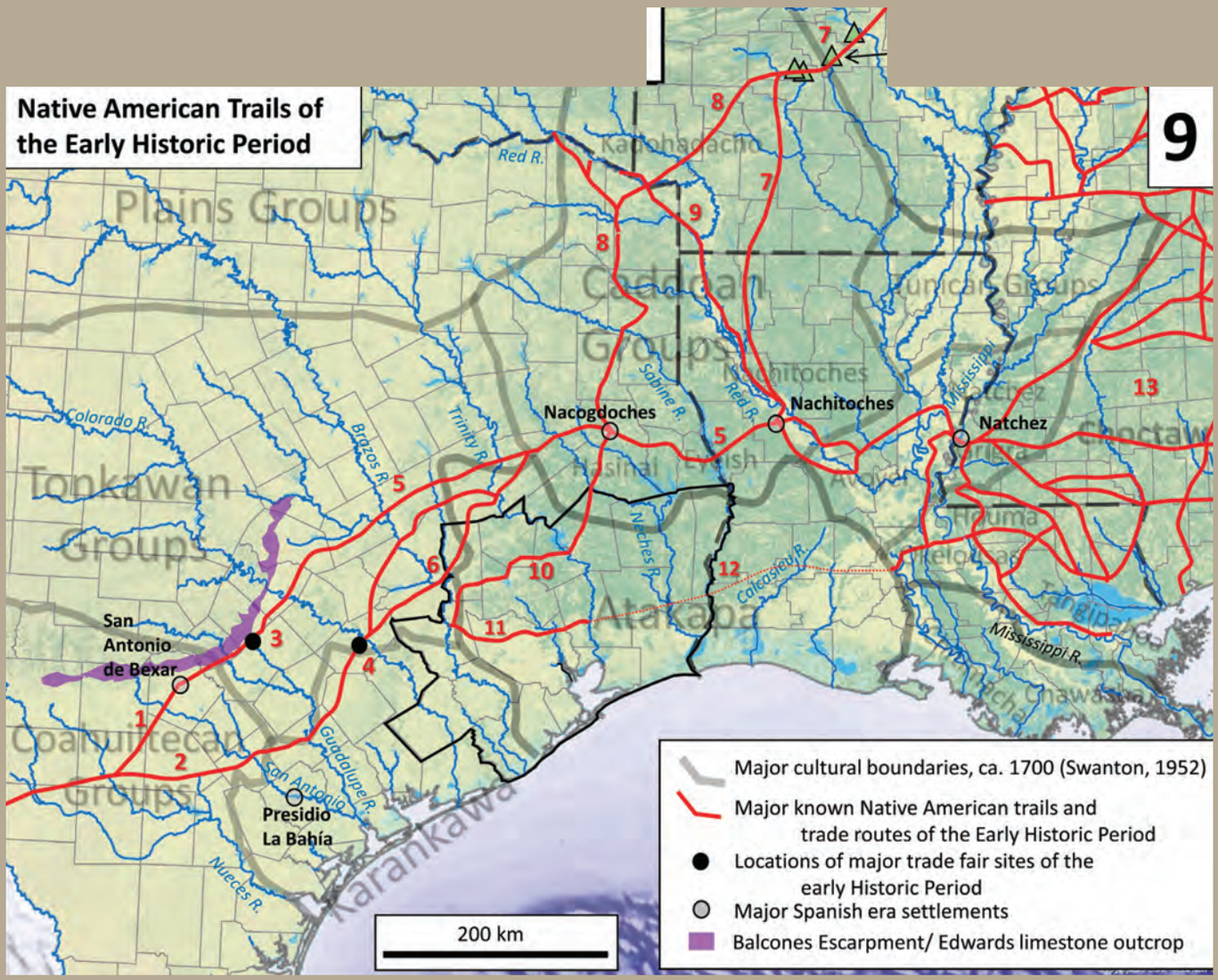
3. Site of a large trade fair between Coahuilan and West Texas cultural groups from the south and west, and Caddoan groups from northeast Texas, that was observed in June 1691 by Governor Domingo Terán. Indians traded goods and hunted buffalo while encamped there (Foster 1995:57–58).

4. Site of a trade fair between Coahuilan and West Texas cultural groups from the south and west, and Caddoan groups from northeast Texas, that was observed in June 1693 by Governor Gregorio Salinas de Verona. The trade fair featured goods, animals, and human captives (Foster 1995:86–87).

5. El Camino Real de los Tejas was a Spanish era entrada route that was placed on the route of a Native American trail. It stretched from the Mississippi River Valley at Natchez to Caddo villages at Nachitoches and Nacogdoches, Spanish San Antonio de Bexar, and ultimately Tenochtitlan (modern Mexico City). The Texas segment is from the National Park Service, El Camino Real de los Tejas National Historic Trail. The Louisiana segment is from Myer (1928; see 13 below).

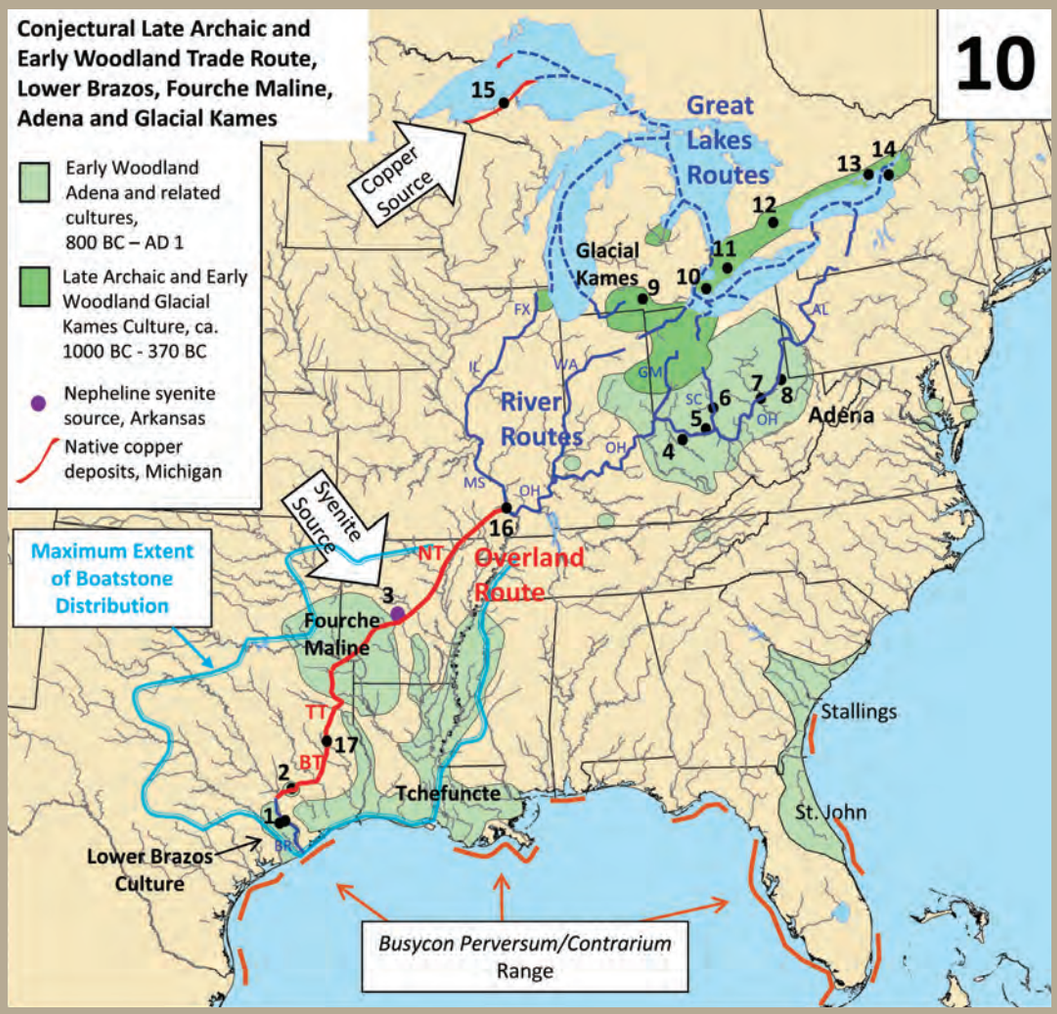
6. Native American trade route reaching from the trade fair site at modern La Grange to the Caddoan centers of northeast Texas, first noted by Governor Alonso de León's expedition of 1690, and a part of it by Terán in 1691. Later it became a segment of the Spanish La Bahía road, linking the La Bahía mission at Goliad with Nacogdoches (Foster 1995:2, 70, 43).

7. The Natchitoches Trace was a major trade route from the Mississippi River basin near Cape Girardeau, Missouri (Houck 1908:226) through Little Rock and Hot Springs, Arkansas, ending at Caddoan Natchitoches. In pre-Columbian times it is thought to have linked Cahokia with the Caddoans (Robison 2018). Hot Springs, Arkansas, is near the specific source vicinity for the nepheline syenite used in many boatstones found throughout the region (Chapter 10). The location of the trace is noted on William Darby's 1816 Map of the State of Louisiana. Trammel's trace is a southwest branch of the Natchitoches Trace leading to Caddoan Nacogdoches, Texas. It is shown on the 1807 Mapa Geográphico de las Provincias Septentrionales de esta Nueva España by José María de Jesús Puelles (Dolph Briscoe Center for American History, Austin) and was researched and located in detail by Pinkerton (2017). Native American in origin, it later became a northern entrance into Texas used by Anglo settlers. See www.natchitochestrace.wordpress.com.




Frame 9, continued.

9. Natchitoches-Tayovaya trail. The Tayovaya were the largest of several bands of the Caddoan Wichita cultural group and lived along the Red River in what is now southern Oklahoma. They were visited in 1719 by Frenchman Bénard de la Harpe, who wished to open up trade with them via the old trail, which mostly followed the Red River northwest from Natchitoches, a Caddoan center (Smith 1959; Woodrick 2019).
10. The Bidai Trail linked Caddoan villages at modern Nacogdoches with Bidai villages on the Trinity River and the Bidai hunting camp of Chief Tomás in Grimes Prairie. Joaquín de Orobio y Basterra used the route in 1746 and noted that it was a Native American trail (Foster 1995:188). Its location is modified slightly from a map by Woodrick (2017). Bidai Chief Tomás's camp was a short distance from Akokisa hunting camps in the headwaters of Spring Creek, a short distance to the south (Woodrick and Linton 2009; see Figure 4.10, this volume), allowing trade between the two groups during the late summer to early winter hunting season.
11. The Akokisa trail was used to connect hunting camps of Chiefs Mateo and El Gordo to the San Jacinto and Trinity rivers. Part of this route was travelled by Orobio Basterra, with Indian guides, in 1746. It went along the south side of Cypress Creek to Spring Creek to the San Jacinto, in much the same place as the later Orcoquisac Road. An extension to Akokisa villages on the lower Trinity (at the mouth of that river) and another to the mouth of the San Jacinto River were likely but are not shown.
12. The Atascosito to Opelousas road. The Opelousas Trail was used as a cattle trail from Texas to Opelousas and New Orleans in Texian days. Although it and its extension into Texas, the Atascosito Road, are sometimes mentioned as having originated as Native American trails, the documentation is elusive (and hence the trail is shown as a dashed line). Opelousas itself was a French trading post founded in 1720, and Darby's map of Louisiana of 1816 does not show a trail heading west from there. Austin's Texas map of 1822 does show this road, however. The Atascosito to Opelousas road was built by the Spanish by 1757 as a connector between the La Bahía mission at Goliad and the Orcoquisac mission to the Atakapa in the Trinity estuary. Although Orobio Basterra appears to have travelled along parts of it prior to that date, in 1746 (see Figure 4.10), he left no indication that it was an active Native American trading route of note. The French trader Blancpain had set up a trading post on the lower Trinity by about 1738 (capturing him was the object of Orobio's mission; Weddle 1991), but it seems he provisioned his post via a marine route into Galveston Bay rather than what would have been a closer overland route to Opelousas,
13. All Native American trails east of Natchitoches are from W. E. Myer's map, *The* [Indian] *Trail System of the Southeastern United States in the Early Colonial Period* (Myer 1928).



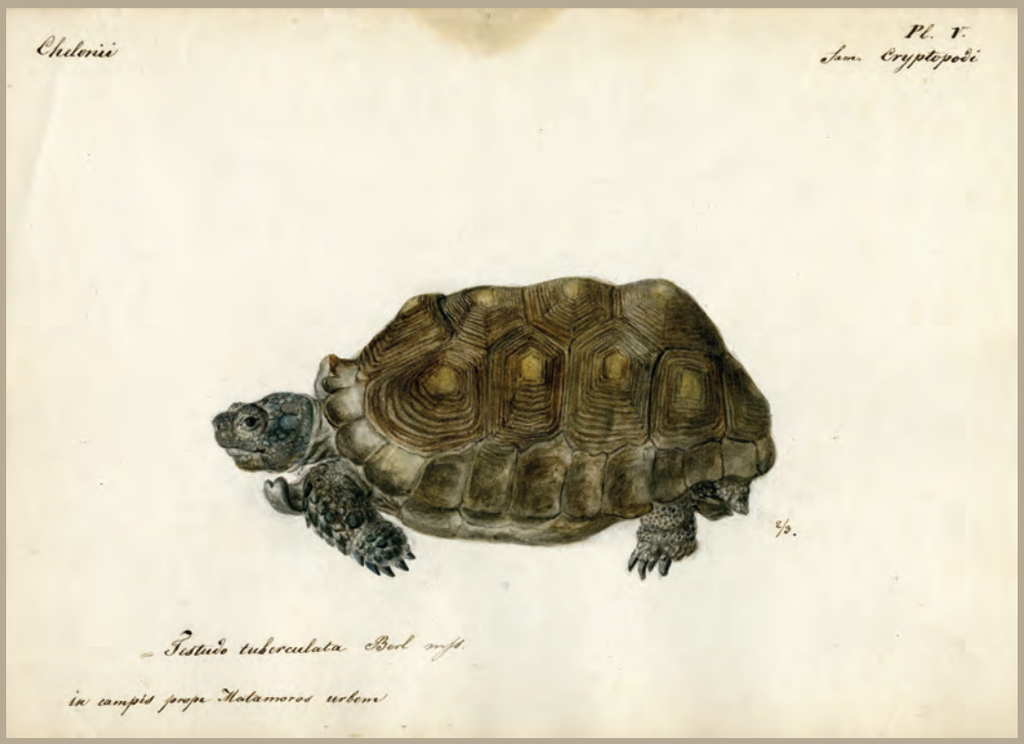

Frame 10. Conjectural Late Archaic and Early Woodland Trade Route, Lower Brazos, Fourche Maline, Adena, and Glacial Kames material cultures, 800 BC–AD 1.

Locations mentioned in text:

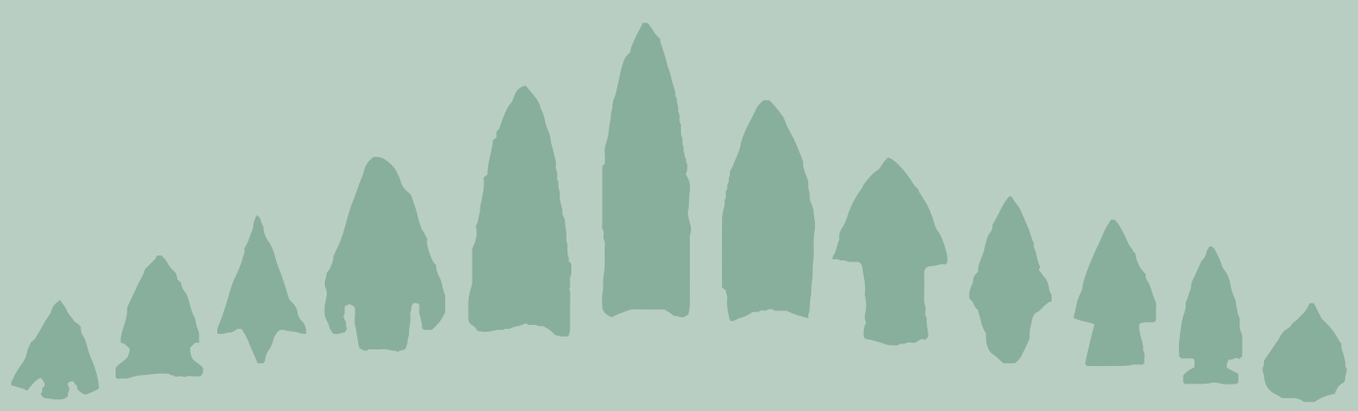
1. Bowser Road site (41FB03), Fort Bend County, Texas, and Witte site (41AU36), Austin County, Texas
2. Dimond Knoll (41HR796), Harris County, Texas
3. Nepheline syenite igneous stocks, Arkansas
4. Fox Farm mounds, Mason County, Kentucky
5. Tremper Mound, Scioto County, Ohio
6. Caldwell Mound and Mound City, Ross County, Ohio
7. Conus (Marietta) Mound, Marietta, Washington County, Ohio
8. Adena Mound at Natrium, Marshall County, West Virginia
9. Burch site, Glacial Kames culture, Branch County, Michigan
10. Sartori site, Glacial Kames culture, Ontario
11. Zimmer and Hind sites, Glacial Kames culture, Ontario
12. Schweitzer site, Glacial Kames culture, Ontario
13. Trenton Mountain site, Glacial Kames culture, Ontario
14. Pictin site, Glacial Kames culture, Ontario
15. Native copper deposits, Keweenaw Peninsula and Isle Royale
16. Terminus of Natchitoches Trail south of Cape Girardeau, Missouri
17. Nacogdoches, Texas

Identified Rivers: AL Allegheny; BR Brazos; FX Fox; GM Great Miami; IL Illinois; MS Mississippi; OH Ohio; SC Scioto; WA Wabash
Overland Route: BT Bidai Trail; NT Natchitoches Trace; TT Trammel's Trace

Sources for trail routes shown are documented in Frame 9, except for northern part of Natchitoches Trace, from Houck (1908). Busycon perversum/contrarium range from Global Biodiversity Information Facility, www.gbif.org.




Texas Tortoise *(Testudo tuberculata)*. Watercolor by Jean Louis Berlandier from his visit to Texas and northeastern Mexico, ca. 1830. Courtesty of the Smithsonian Institution Archives.

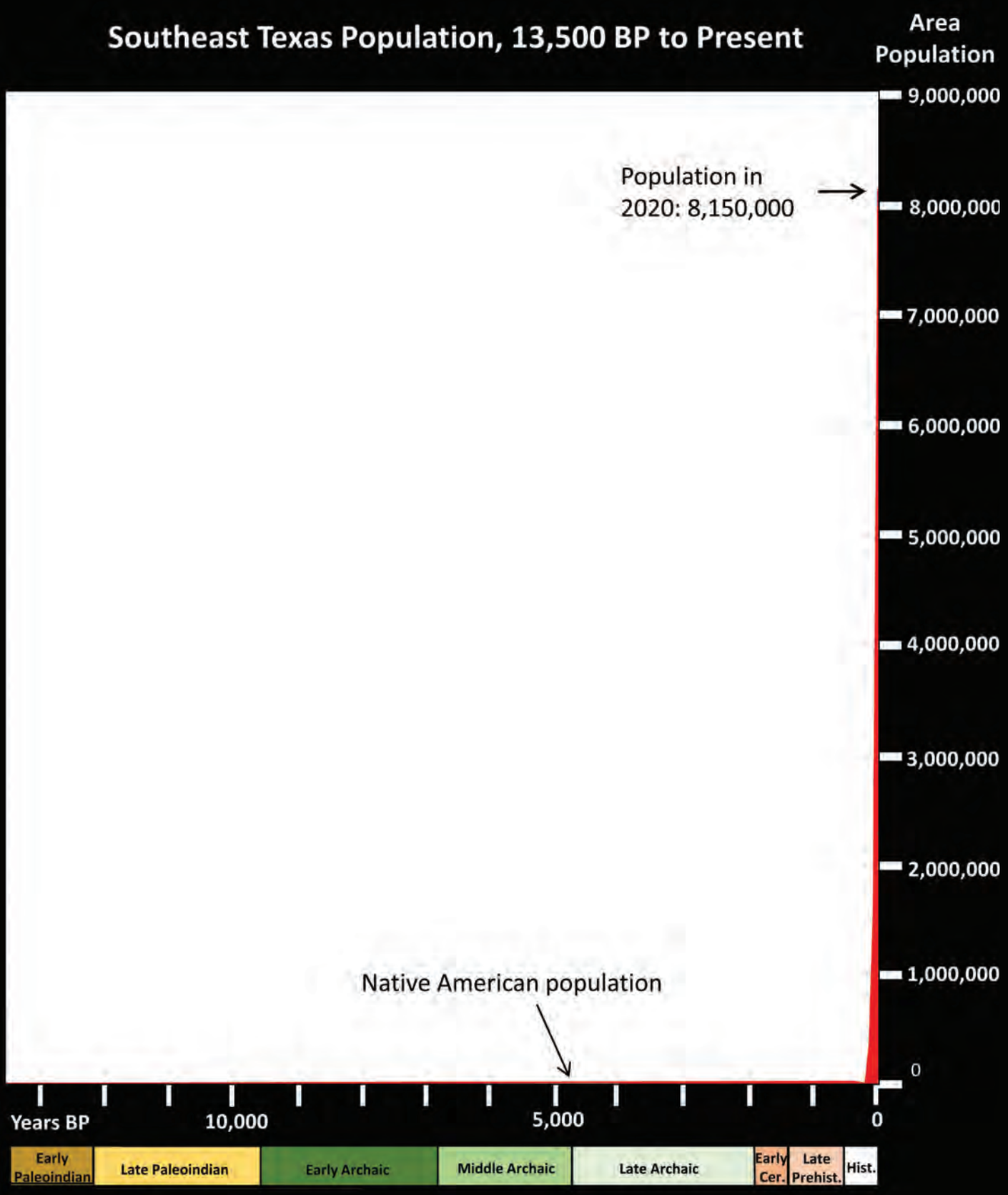


# 12.

# Into the Anthropocene

When we stroll down a forest or prairie path, or along a beach, and encounter an artifact—perhaps a piece of an arrow point, a piece of a worked stone, or a sherd of pottery—it is often a moment for a two-part reflection. "How different a world they lived in" is typically our first thought. "How different a world we live in" may be our second thought. One great benefit of archeology, the science of prehistory, is its ability to give us a very long-term perspective on the human condition, which we can use to reflect upon the nature of our own time. Consider for a moment the perspective afforded by the population chart shown on Figure 12.1. As discussed in previous chapters, Native Americans have been continuous residents of Southeast Texas since the time of the Clovis material culture 13,500 years ago, and very probably were residents of the coastal area even farther back, to the time of settlement of the Gault site in upland Bell County perhaps 20,000 years ago. Combining estimates of the Native American population of Southeast Texas prehistory over time (see Chapter 4) with those from historical and recent U.S. census data allows several trends to become clear.

The Native American population, even at its maximum in about AD 1700, is less than the width of a pencil line on that chart compared to the unprecedented, steep population growth in Southeast Texas during the last century. Spanish indications of population at about AD 1700 yield an estimate of about 4,000 to 5,000 persons in Southeast Texas at that time, before the disastrous epidemics of


Southeast Texas Population, 13,500 BP to Present
Area Population
9,000,000
8,000,000
7,000,000
6,000,000
5,000,000
4,000,000
3,000,000
2,000,000
1,000,000
0
Population in 2020: 8,150,000
Native American population
Years BP
10,000
5,000
0
Early Paleoindian
Late Paleoindian
Early Archaic
Middle Archaic
Late Archaic
Early Cer.
Late Prehist.
Hist.

the middle and late eighteenth century got underway. It is possible that population was even higher earlier, before Governor Alonso de Léon made his entrada in 1689; the spread of diseases could have begun from the time of Hernán Cortés in Mexico in 1520, or from Álvar Núñez Cabeza de Vaca's landing on the Texas coast in 1528, or from Hernando de Soto's visit to East Texas in 1541. Even if epidemics did spread from those earlier visits to the greater Texas-Mexico region, and decimated the population before there were European observers to record it, a Native American population an order of magnitude higher than that of AD 1700 would still be hardly a blip compared to what was to come in our own time.

Such small population numbers should not minimize the importance of the accomplishments of the Native Americans who were here. Rather, these relatively small population numbers serve to magnify what these hunter-gatherer people were able to do:

> They were here for at least 13,500 years—at least 650 generations—of sustainable occupancy of this land. When they were overcome in the eighteenth and early nineteenth century by insurmountable obstacles brought by the Columbian Exchange, the Southeast Texas landscape and its flora and fauna that they left behind were still in excellent shape.
>
> Throughout their long history, the people of the Trinity-Sabine Tradition and their Atakapan descendants dealt with a more or less continually warming climate and ever-rising seas that took away a quarter of the physical landscape that they called home. In part of that time, they experienced rates of sea level rise that were several times greater than those predicted for our immediate future, and they nevertheless thrived.
>
> They managed thousands of acres of prairie, keeping it clear of invasive trees by annual burning, and at the same time harvested food resources from the vast bison herds that were periodic visitors, devising geographically advantaged kill sites that were used again and again over thousands of years. In essence, as Cronon (1983) observed, they and other bison-hunting people of the Early Historic Period were ranching at such an expansive scale that European settlers could not recognize it for what it was.
>
> In spite of such small population numbers, they still managed to participate in exchange systems with other groups that reached deep into the core of the continent. Exchange was not only a matter of material goods, but seems to have included rituals and beliefs, and those exchanges ultimately involved people as far north as Ontario.
>
> They managed cultural cohesion within relatively small groups over thousands of years, with sharp cultural boundaries with outside groups that were defined by vast differences in language and custom. At the same time, they adapted to new skills and technologies of their neighbors, including the use of ceramics and of the bow and arrow.

Figure 12.1. Population chart, Southeast Texas, from the time of its first known residents during the time of the Clovis material culture, 13,500 years ago. Data for the recent past from the U.S. Census.

Regardless of their mastery of their local environment, they disappeared almost completely within a few decades of encountering European disease and colonial land ownership policies; it was for them an unanticipated and completely unprecedented event.

Moving to a population perspective of our town time, consider the population of Southeast Texas since the European settlement of the region—the right edge of Figure 12.1. Within a little more than the past century the population of Southeast Texas has increased to a level over a thousand times as high as that of Native Americans at their peak. The rate of increase, viewed from the perspective of the human history that has preceded us here in this region, can only be described as explosive. Within just the lifetime of all reading this book, our population has exploded at a rate unprecedented in all of human history.

This unprecedented growth is not restricted to this area; it is a global phenomenon. The rapid acceleration of population growth since 1945 has been noted in hundreds of large cities worldwide and has a straightforward name—the Great Acceleration (McNeill and Engelke 2014). It marks the beginning of a proposed new geologic epoch to follow the Holocene: the Anthropocene, named for a time when humans demonstrated significant impact on the geology and ecosystems of our planet, sufficient that future geologists could define a distinct stratigraphic level at its starting point. That starting point is perhaps most often reported as 1945, the beginning of the atomic era as well as the beginning of the massive post-war global boom in consumer goods and population. Whatever its starting point, the early Anthropocene's über-rapid growth in population and unconstrained urban and suburban growth has been accompanied by an unparalleled destruction of our natural habitat. When future archeologists view our culture, our paper, cloth, wood, and (most) plastic artifacts will long since have deteriorated in our humid climate. What they will see most in our region will be concrete—miles and miles of it, covering vast swaths of land as former roads, parking lots, sidewalks, house foundations, public and commercial building foundations, concrete-lined bayous for flood control, and more.

Our global population has more than tripled during this Great Acceleration—within the lifetime of many senior citizens alive today—and the population of Southeast Texas has grown even faster, by 553% from 1950 to 2020, according to U.S. Census data. Well over half of that population growth was in Harris County, home of the City of Houston. From the end of the Pleistocene throughout the Holocene, this area was the home of prairies, forests, and coastal marshes. Within the lifetime of our older citizens, within only the blink of an eye compared to our area's human history, this situation abruptly changed. The extent of the global human footprint that resulted from increased human presence during the Great Acceleration was mapped by the NASA-sponsored Socioeconomic Data and Applications Center (SEDAC) at Columbia University (Venter et al. 2016, 2018). Using satellite data, they considered four main factors in measuring "human footprint" and its impact upon biodiversity: population density, land transformation, human access, and power infrastructure. Quantitative global maps gridded to the scale of 1 km were prepared for the years 2009 and 1993, and then the difference was plotted in terms of high (dark gray) and low (light gray) human footprint. A portion of their

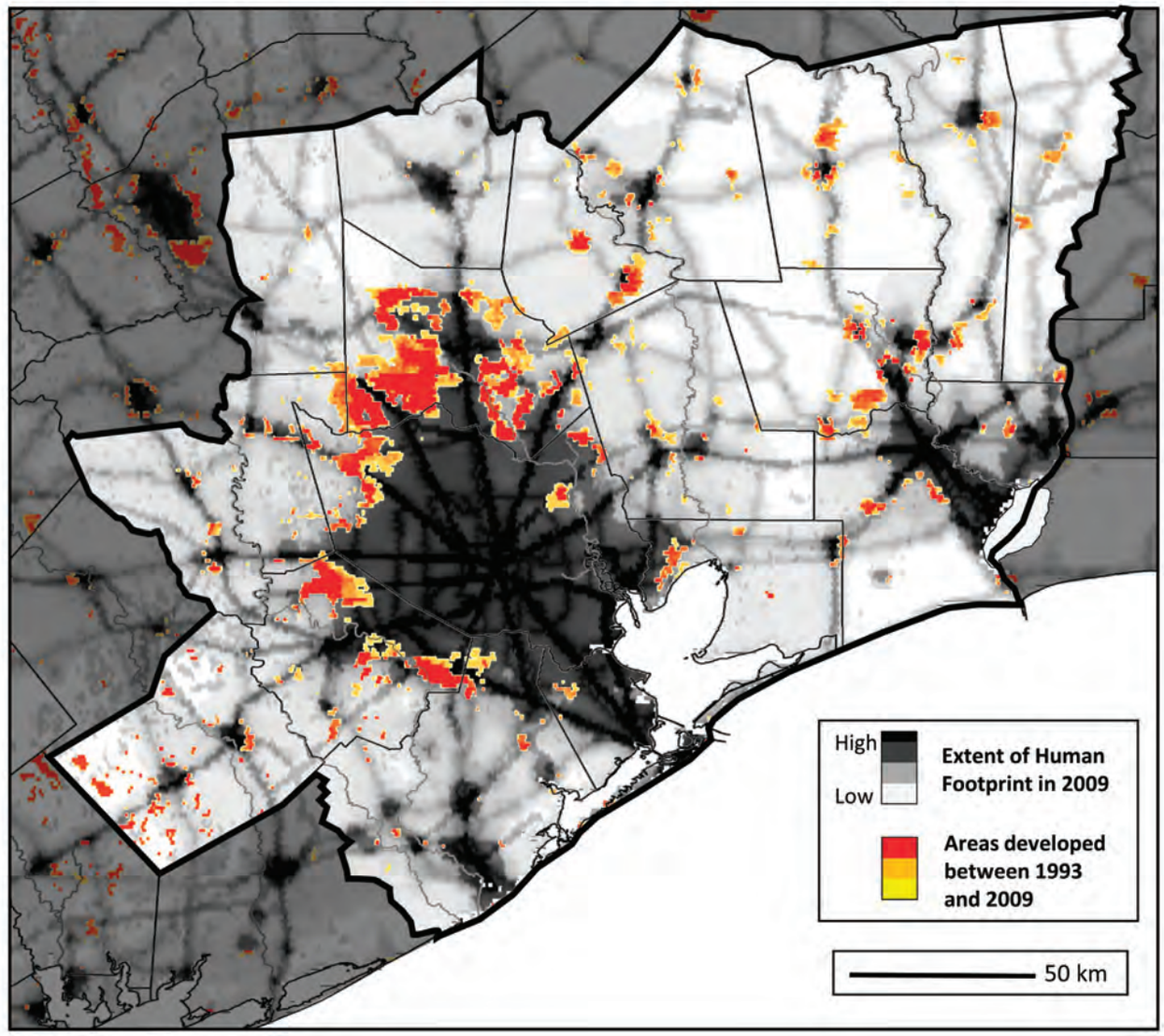



Figure 12.2. A "human footprint" map of Southeast Texas. Black to white shading represents the extent and intensity of the area's human footprint (impact upon biodiversity, mostly as a result of urbanization) in 2009, as calculated by the Socioeco-nomic Data and Applications Center (SEDAC) at Columbia University (Venter et al., 2016, 2018). The red and yellow areas identify the parts of that area impacted during 1993 and 2006, highlighting the areas of most recent change.

calculations for Southeast Texas is shown in Figure 12.2. The dark gray to black area shows the extent and degree of our area's high-level human footprint in 2009, the most recent time for which such a calculation is available. The dark area is heavily urban, with age-old prairie and forest landscapes nearly completely replaced by an urban and suburban landscape. The red and yellow portions represent the areas of high increase in human footprint between 2009 and 1993—in effect, the areas of most recent growth, as the Great Acceleration continues.

The footprint map shows a pattern that looks very much like an explosion—as indeed it has been from any long-term perspective—or perhaps like a prairie fire, rapidly expanding outward from its center. Even from our everyday short-term perspective, this is astonishingly rapid growth. In just the time of one full lifespan, a third of Southeast Texas has been irretrievably turned from natural to urban habitat, and an entire region of former Trinity-Sabine/Akokisa prairie bison hunting sites, river habitat, and coastal shell-fishing sites were permanently altered or destroyed. Compared to the long timeline of the Native American occupation of this land (the scale at the bottom of Figure 12.1), this change has come at lightning speed.

Whatever the future duration of the Anthropocene, the Great Acceleration that began it must necessarily be short. Urban areas like Houston require vast amounts of environmental area *outside of* their directly developed urban areas to support their lifestyle (Rees and Wackernagel 1994; Moore 2011). That considerably limits the degree to which the Global Acceleration can continue. As McNeill and Engelke put it, "There are not enough big rivers left to dam up, enough oil left to burn, enough forests left to fell, enough marine fish left to catch, enough groundwater left to pump up" to sustain the explosive rate of global and local increase in population and resource use seen in the last 75 years. The rate of Southeast Texas population growth depicted on Figure 12.1, like that of the globe as a whole, is not sustainable for any long duration into the future without an unknowable large, near-future change in the way we interact with resources and our environment. No one knows exactly when the Great Acceleration will slow or stop, but a recent study in the *Lancet* suggests that global population growth will peak at 9.7 billion people, in 2064, and decline by a billion by the end of the century as a result of global fertility decline that has already begun (Vollset et al. 2020).

Where will this Great Acceleration take us in the very near future? Will rapid growth at the city's margin (and that of Beaumont and Port Arthur to the east) eventually expand to consume most of East Texas, much as cities along the Eastern Seaboard of the United States have grown, coalesced, and formed a massive urban corridor? Or will Greater Houston show its characteristic entrepreneurial side and find ways to channel growth more intensively inward (away from its ever-expanding suburban and exurban borders) and upward, saving some of what is left of our area's natural heritage? If we could ask our grandchildren these questions in their old age, we would very likely find they know the answers. Finally, will our culture be able to sustain itself in this coastal environment for anything like the many millennia that Native Americans were able to thrive here? These are questions that come to mind while examining a pottery sherd found along a forest trail.

Berlandier's Owl *(Strix turquata),* drawn by French naturalist Jean Louis Berlandier on his visit to Texas and northeastern Mexico, ca. 1830. Courtesy of the Archives of the Smithsonian Institution.

Rapaces nocturni
Pl. X
Fam. Ægolii.
Strix torquata Bird. mſs.
Habitat prope Matamoros urbem. Vulgo Tecolote.

# Acknowledgments

This effort is part of an ongoing personal mission of discovery into the natural history and human prehistory of the Houston area and its surrounding Southeast Texas region, my family's home for several generations and a place of which I am very fond. As mentioned earlier, I come at this avocational effort from the perspective of a regional geologist. We regional geologists revel in maps, and we always seem to search for a map-based understanding of our chosen topic. Most of the Southeast Texas geologic landscape is very young indeed (the mud and sand deposits of our coastal areas are barely as old as the last glacial cycle, which started just 120,000 years ago), and that means there is some overlap here in the time scales of earth history, prehistory, and human history. That fact is comforting as I tread ever so lightly into the less familiar realms of the historian, ethnologist, and archeologist. It has been the professional and avocational scientists from these three fields—plus others from more familiar fields of geology and data management—to whom I turned for assistance in my travels, and I have been blessed by their generous help.

I could not have produced the paleogeographic maps of the area without the help and active participation of Professor John B. Anderson, whose career of work on the coastal geology of Texas with his many students at Rice University has provided scientists and government planners with a careful appraisal of the changing dynamics of our Texas coastlines. In that regard, I thank one of his former students, Alex Simms, for providing the digital version of an offshore Late Pleistocene erosional map on which much of the paleogeography in this report was based. Taking the Rice coastal research data and preparing a three-dimensional model of it, essential for the preparation of regional paleogeographic maps, was enabled by the generous assistance of two geoscientists at the Houston office of Compagnie Générale de Géophysique (CGG), Don Dobesh and Rosemary Neyin. I am very grateful to them and to CGG for the many long hours they were able to spend helping me, using their company's geophysical modeling software.

All who study the prehistory of the Southeast Texas region owe a debt to the late Leland Patterson, former chair of the Houston Archeological Society (HAS), for a lifetime of avocational archeological field research and, in particular, for his foresight in placing that lifetime of research by him and others into a digital database. I thank Linda Gorski, the current HAS chair, as well as Louis Aulbach for familiarizing me with that database, which had lain largely fallow for a quarter century, and thanks go to Roger Moore, founder of Moore Archeological Consulting, for unearthing an otherwise lost digital copy of it. Linda also helped me find a way to connect that HAS data with geographical information and encouraged the work in many ways. Wilson W. (Dub) Crook and Larry Golden, also of HAS, generously provided photographs of archeological artifacts of the region. Joe D. Hudgins of Hungerford, Texas, whose passion for archeology was the catalyst for the HAS exploration of the San Bernard Prairie in the 1980s and 1990s, as well as fellow HAS member Gary Ryman, graciously took me to the 41WH19 site in that prairie to grasp the lie of the land in what may once have been a bison leap from a high bluff

into West Bernard Creek.

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A dive into the Spanish and French history of the Southeast Texas region was greatly helped by following the academic footsteps of the late historians Herbert Eugene Bolton and Robert Weddle, who in previous eras carefully documented our area's history using primary source material. In more recent times Austin historian James Woodrick has returned to many of those same primary sources and provided a fresh, updated, and GIS-supported take on the geography of Spanish and French travels and events in our region. It is not easy to find someone knowledgeable in the comings and goings of Orobio Basterra and other Spaniards of the eighteenth century, in order to discuss the locations of these early sites. Mr. Woodrick was the perfect contact, and a pleasure to consult.

The beautiful original woodcuts that grace a few pages of this volume were created by the well-known Austin artist Barbara Whitehead. Many other illustrations were provided by the Peabody Museum of Archeology and Ethnology at Harvard University, the DeGolyer Library at Southern Methodist University, and the natural history and anthropological archives of the Smithsonian Institution. Fulshear resident Margie Bass generously provided access to Native American artifacts from her collection for photographing. Sally Antrobus provided a careful, detailed copy-editing of the work that saved the reader from many annoying glitches and syntax errors. D. J. Hacker, of Brooklyn, New York, and my cousin, Drew Patterson of Austin, graciously helped me with some of the finer points of book design.

The literary and technical contents of this volume benefitted greatly from careful reviews by Tom Williams, assistant director of archeological research at the Gault School of Archeological Research in Austin, who commented on Clovis and pre-Clovis portions; by retired archeologist and historian Melissa Crowfoot Keane, also of Austin, who gave a historian's high level overview of the volume; and by archeologist Wilson (Dub) Crook and retired Chevron geologist Ric Frasse, both members of the Houston Archeological Society, who commented on parts or all of

the manuscript. Despite these reviewers' best efforts to educate me, there are doubtless some remaining errors in this manuscript, and those shortcomings rest entirely at the feet of the author.

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Finally, I thank my wife, Mary Helen Worrall, for her patient and constant support as I follow my historical and archeological will-o'-the-wisp.

# Appendix 1. Late Pleistocene Megafauna Fossil Sites of Southeast Texas

**Appendix 1: Late Pleistocene Megafauna Fossil Sites of Southeast Texas**

| Site | Location | County | Latitude | Longitude | Mammoth | Bison | Horse | Camel | Mastodon | Ground Sloth | Tapir | Gomphothere | Glyptodon | Giant armadillo | Capybara | Giant Beaver | Dire wolf | Sabre-Tooth Cat | Bear | Jaguar | Deer | Pronghorn | Peccary | Manatee | Early man associations | Sources |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Sour Lake, Hardin Co | Hardin | 30.13975 | -94.410742 | | | Y | | Y | Y | | | | | | | | | | | | | | | | Hay 1924: p. 3, 20, 126; Leidy 1868, 242. |
| 2 | San Felipe, Austin Co., Brazos below town | Austin | 29.80466 | -96.084042 | Y | Y | Y | Y | Y | Y | Y | | | | | | | | | | | | | | | Hay, 20; Carpenter, 1846; Leidy, 1870; Buckley, 1874; also see Geiser 1945 on Huff |
| 3 | "50 miles above mouth of Brazos," Ft. Bend Co., bed of Brazos | Fort Bend | 29.57479 | -95.718432 | Y | | | | Y | Y | | | | | | | | | | | | | | | | Hay, 3-4, 20; Wyman, 1856 |
| 4 | Harris Bend, Buffalo Bayou, near Harrisburg, Harris Co. | Harris | 29.72114 | -95.275357 | | | | | Y | | | | | | | | | | | | | | | | | Hay, 20 |
| 5 | McDowell, Austin Co., in Brazos River | Austin | 29.77158 | -96.037322 | Y | | | | Y | | | | | | | | | | | | | | | | | Hay, 20, 63, 93; Houston Post 11/16/1910 with photo |
| 6 | Sealy, Austin Co., in the "big bend" of the Brazos River | Austin | 29.83619 | -96.122003 | | | | | Y | | | | | | | | | | | | | | | | | Hay, 21 |
| 7 | Navasota, Grimes Co., Brazos River | Grimes | 30.371 | -96.14919 | Y | | | | | | | | | | | | | | | | | | | | | Hay, 62, 105 |
| 8 | San Leon, Galveston Co., shore of Galveston Bay | Galveston | 29.48623 | -94.915699 | Y | | | | | | | | | | | | | | | | | | | | Y | Hay, 63, 92, 105; Note: see discussion in Gallaway 2011 on human remains found near mammoth site |
| 9 | Houston, Harris Co., at "new" Masonic Lodge | Harris | 29.72933 | -95.390709 | Y | | | | | | | | | | | | | | | | | | | | | Hay, 63 |
| 10 | Alvin, Brazoria Co., ditch 3.5 mi. SW of town | Brazoria | 29.41012 | -95.258061 | Y | | | | | | | | | | | | | | | | | | | | | Hay, 63 |
| 12 | Buckeye, Matagorda County, on Colorado River | Matagorda | 28.89486 | -96.033143 | Y | | | | | | | | | | | | | | | | | | | | | Hay, 92, 106 |
| 13 | San Bernard River between Wallis and Chesterville in Lissie Fm. | Colorado | 29.62275 | -96.145166 | Y | | | | | | | | | | | | | | | | | | | | | Hay, 93 |
| 14 | Pittsbridge. See map of Pittsbridge in Hay p 244, due W of Bryan on River | Brazos | 30.60631 | -96.468546 | Y | Y | Y | Y | Y | | | | | | | | | | | | | | | | | Hay, 18, 61-62, 89, 105, 128, 162, 187 |
| 15 | near Brenham, Washington County | Washington | 30.18588 | -96.355897 | Y | | | | | | | | | | | | | | | | | | | | | Hay, 90 |
| 16 | Millican, Brazos County | Brazos | 30.46587 | -96.204476 | Y | | | | | | | | | | | | | | | | | | | | | Hay, 90 |
| 17 | Eagle Lake, Austin County | Austin | 29.58703 | -96.334691 | Y | | | | | | | | | | | | | | | | | | | | | Hay, 106 |
| 18 | on San Bernard River, Brazoria Co. | Brazoria | 29.01133 | -95.783893 | Y | | | | | | | | | | | | | | | | | | | | | Hay, 106 |
| 19 | Bay City, Matagorda Co. | Matagorda | 28.9845 | -95.999219 | Y | | | | | | | | | | | | | | | | | | | | | Hay, 106 |
| 20 | near Lissie, Wharton Co. | Wharton | 29.5615 | -96.204815 | | | Y | | | | | | | | | | | | | | | | | | | Hay, 130. note: this horse recently placed in new genus; see https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5705217/ |
| 21 | near Egypt, Wharton Co., on Colorado River | Wharton | 29.40276 | -96.239704 | | | Y | | | | | | | | | | | | | | | | | | | Hay, 130 |
| 22 | near Richmond on Brazos River | Fort Bend | 29.60685 | -95.752102 | Y | | | Y | | | | | | | | | | | | | | | | | | Hay, 106, 162; also Carpenter, 1846 |
| 23 | Wallis Station, Austin Co. | Austin | 29.63225 | -96.065252 | | Y | | | | | | | | | | | | | | | | | | | | Hay, 188 |
| 24 | Houston, Harris Co., Scott Street bridge at Brays Bayou | Harris | 29.70984 | -95.35659 | | | | | | | | | | Y | | | | | | | | | | | | Levine, 2002 (found 1955) |
| 25 | Houston, Harris Co., Chimney Rock canal, Chimney Rock at Valkeith | Harris | 29.67208 | -95.476825 | Y | | Y | | | | | | | | | | | | | | | | | | | Levine, 2002 (found 1961) |
| 26 | Houston, Harris Co., somewhere on Dairy Ashford | Harris | 29.7862 | -95.606571 | | | | | | Y | | | | | | | | | | | | | | | | Levine, 2002 (found 1961) |
| 27 | Houston, Harris Co., Upper Armand Bayou | Harris | 29.65044 | -95.129447 | Y | Y | Y | | Y | | Y | | | | | | | | | | Y | | Y | Y | Y | George Wolf, 2011b |
| 28 | Houston, Harris Co., Sims Bayou | Harris | 29.63183 | -95.387171 | Y | Y | Y | Y | Y | Y | Y | | Y | Y | Y | | Y | | Y | | Y | Y | | | | George Wolf, 2011c; Slaughter and McClure, 1965; Slaughter, 1966; Lundelius, 1972 |
| 29 | Texas City, Galveston Co., Texas City dike | Galveston | 29.38986 | -94.882293 | Y | Y | Y | Y | Y | Y | Y | | Y | Y | Y | | Y | Y | | | Y | Y | | | Y | George Wolf, 1992 and 2011d; Aten and Good, 1984 (see discussion of human remains, p. 461) |
| 30 | Chambers and Jefferson Counties, McFadden Beach | Chambers | 29.56479 | -94.354698 | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | | | Y | Y | Y | Y | Y | Y | Y | | Y | Brown, 2018; Russell, 1975; Turner and Tanner, 1994. |
| 31 | Damon Mound, Brazoria Co. | Brazoria | 29.29597 | -95.751131 | | Y | Y | Y | Y | Y | Y | | Y | | | Y | Y | | | | Y | Y | | | Y | John T. Jenkins, Jr., 1978; also see table in Brown; Hester for Clovis |
| 32 | Channelview, Harris County, Texas, near de Zavala Elementary School | Harris | 29.77952 | -95.115011 | | Y | Y | | | Y | Y | | | | | | | | | | | | | | | George Wolf, 1992 |
| 33 | San Jacinto State Park, Harris County, Texas | Harris | 29.75403 | -95.071193 | | Y | Y | | | | | | | | | | Y | | | | | | Y | | | George Wolf, 1992 |
| 34 | Houston, Harris County, Texas, Sims Bayou at Airport Rd. crossing | Harris | 29.64527 | -95.367381 | | | Y | Y | | Y | | | | | | | | | | | | | | | | George Wolf, 1992 |
| 35 | Pasadena, Harris County, Texas, Taylor Bayou | Harris | 29.61133 | -95.030984 | | Y | Y | | | | | | Y | | Y | | | | | | Y | | | | | Kaspar, 1973; Kaspar and McClure, 1973; also Wolf, 1992 |
| 36 | Oyster Creek near Clute, Brazoria County | Brazoria | 29.04075 | -95.406004 | Y | Y | Y | | | | | | | | | | | | | | | | | | | Urista, 2009 and Berger, 2004 |
| 37 | Wood Springs, Liberty County Texas | Liberty | 30.09009 | -94.761667 | | | | | Y | | | | | | | | | | | | | | | | Y | Crook, 2017 |
| 38 | McGregor Park on Braes Bayou | Harris | 29.71428 | -95.336926 | | | | | | | | | Y | | | | | | | | | | | | | Atkinson, 1955; this is the Houston Science Museum's glyptodont |
| 39 | Hidalgo Falls, Washington and Brazos Counties | Washington | 30.39343 | -96.176626 | Y | | Y | | Y | Y | | | | | | | | | | | | | | | | Hay, 3 |
| 40 | Chapel Hill (at west side Brazos River facing Hempstead) | Washington | 30.12846 | -96.186999 | | | | | Y | | | | | | | | | | | | | | | | | Hay, 19 |
| 41 | Leota, near osceola Plantation, Bedias Creek at Trinity River | Madison | 30.9281 | -95.619678 | | | | | Y | | | | | | | | | | | | | | | | | Hay, 19 |
| 42 | Clapps Ferry, 10 mi west of Trinity. Ferry was at Hwy 21 crossing of Trinity | Trinity | 31.07767 | -95.700297 | | | | | Y | | | | | | | | | | | | | | | | | Hay, 19 |
| 43 | Drew's Landing on Trinity River | San Jacinto | 30.55541 | -94.886405 | | | | | Y | | | | | | | | | | | | | | | | | Hay, 19, 105 |
| 44 | Port Arthur | Jefferson | 29.9398 | -93.868287 | | | | | Y | | | | | | | | | | | | | | | | | Hay, 19, 242 |
| 45 | Trinity, Trinity County | Trinity | 30.9332 | -95.412863 | Y | | | | | | | | | | | | | | | | | | | | | Hay, 59 |
| 46 | Onalaska | Polk | 30.80264 | -95.147731 | Y | | | | | | | | | | | | | | | | | | | | | Hay, 61-62 |
| 47 | White Rock Shoals on Trinity River | Trinity | 30.90282 | -95.278657 | Y | | Y | | | | | | | | | | | | | | | | | | | Hay, 105, 128 |
| 48 | Dyersdale site, Greens Bayou 41HR60A | Harris | 29.907 | -95.2373 | Y | | | | Y | | | | | | | | | | | | | | | | Y | Howard, Freeman and Bousman, 1991. Clovis point |

## Appendix 2. Bison Bone Occurrences at Southeast Texas Sites

| SITE ID | ZONE | TIME PERIODS | REFERENCE |
|---|---|---|---|
| 41BO79 | Coastal | LPr | Patterson, 1996 |
| 41CH110 | Coastal | LPr | Patterson, 1996 |
| 41CH16 | Coastal | EC | Patterson, 1996 |
| 41CH161 | Coastal | LPr | Patterson, 1996 |
| 41CH172 | Coastal | LA | Patterson, 1996 |
| 41CH31 | Coastal | LPr | Patterson, 1996 |
| 41GV53 | Coastal | ND | Patterson and others, 2001 |
| 41GV66 | Coastal | LPr | Patterson, 1996 |
| 41HR39 | Coastal | ND | Patterson, 1996 |
| 41HR50 | Coastal | LPr | Patterson, 1996 |
| 41HR72 | Coastal | ND | Patterson and others, 2002 |
| 41HR82 | Coastal | LPr | Patterson, 1996 |
| 41 WH12 | San Bernard | LPr | Patterson, 1996 |
| 41 WH14 | San Bernard | ND | Patterson, 1996 |
| 41AU4 | San Bernard | ND | Patterson, 1996 |
| 41FB245 | San Bernard | ND | Patterson Hemming and McClure, 1997 |
| 41FB28 | San Bernard | ND | Patterson, Hudgins and McClure, 2000 |
| 41FB37 | San Bernard | EA | Patterson, 1996 |
| 41FB43 | San Bernard | LPr | Patterson, 1996 |
| 41WH19 | San Bernard | Pi, A, EC, LPr | Patterson, 1996 |
| 41WH36 | San Bernard | Lpr | Patterson, 1996 |
| 41WH72 | San Bernard | LPr | Patterson, 1996 |
| 41WH74 | San Bernard | LPr | Patterson, 1996 |
| 41FB223 | Katy | A | Patterson, 1996 |
| 41FB282 | Katy | LPr | Patterson, Hudgins, and Palmer, 2000 |
| 41FB95 | Katy | ND | Patterson, 1996 |
| 41HR182 | Katy | ND | Patterson, 1996 |
| 41HR273 | Katy | EC | Patterson, 1996 |
| 41HR278 | Katy | ND | Patterson, 1996 |
| 41HR279 | Katy | ND | Patterson, 1996 |
| 41HR281 | Katy | ND | Patterson, 1996 |
| 41HR292 | Katy | LA | Patterson, 1996 |
| 41HR406 | Katy | LPr | Fields, 1988 |
| 41HR5 | Katy | MA, EC, LPr | Patterson, 1996 |
| 41HR541 | Katy | LPr | Patterson, 1996 |
| 41HR6 | Katy | LPr | Patterson, 1996 |
| 41HR7 | Katy | LPr | Patterson, 1996 |
| 41HR796 | Katy | ND | Barrett and Weinstein, 2014 |
| 41WL27 | Katy | LPr | Patterson, Hudgins, and Palmer, 2005 |

Symbols: Pi=Late Paleoindian; EA=Archaic; MA=Middle Archaic; LA=Late Archaic; A=Archaic undifferentiated; EC=Early Ceramic; LPr=Late Prehistoric; ND=No data.

Patterson (1996) included a compilation of most of these data, with further references; his data have been updated for this report. The "Zones" include the San Bernard Corridor (in between the Colorado and Brazos Rivers), the Katy Corridor (in between the Brazos River and the East Texas Forest); and the Coastal Zone of sites near the modern coast.

# References

Note: The following list provides references cited in the text, including references to archeological sites specifically mentioned. Not all sites in the Southeast Texas project database are discussed in the text, including many sites that exist as points on maps but are not otherwise discussed. For these sites, readers are referred to two bibliographies of Southeast Texas archeology: Moore (2015) and Patterson (2005a), both listed here. Moore's bibliography is more up to date, with cross-referencing by author, key word, site number, and county. Both bibliographies are readily available online, as are all the reports of the Houston Archeological Society (www.txhas.org).


Adams, Jenny
1999 Refocusing the Role of Food-Grinding Tools as Correlates for Subsistence Strategies in the U.S. Southwest. *American Antiquity* 64(3):475–498.
2014 Ground Stone Use-Wear Analysis: A Review of Terminology and Experimental Methods. *Journal of Archeological Science* 48:129–138.

Adovasio, J. M., and David R. Pedlar
2019 Late Pleistocene Occupation(s) in North America. In *People and Culture in Ice Age Americas,* edited by Rafael Suarez and Ciprian F. Ardelan, pp. 172–182. University of Utah Press, Salt Lake City.

Alroy, John
2001 A Multispecies Overkill Simulation of the End-Pleistocene Megafaunal Mass Extinction. *Science* 292 (5523):1893–1896.

Allen, J. A.
1876 *The American Bison, Living, and Extinct*. Memoir of the Geological Survey of Kentucky 1 (pt. 2). University Press, Cambridge.

Ambler, J. R.
1967 Three Prehistoric Sites Near Cedar Bayou, Galveston Bay Area. Office of the State Archeologist, State Building Commission, Austin, Texas, Report 8.
1970 *Additional Archeological Survey of the Wallisville Reservoir Area, Texas*. Report no. 6, Texas Archeological Salvage Project.

Anderson, D. G., and H. A. Semkin Jr. (editors)
1980 *The Cherokee Excavations: Holocene Ecology and Human Adaptations in Northwestern Iowa*. Academic Press, Cambridge, Massachusetts.

Anderson, David G.
1990 The Paleoindian Colonization of Eastern North America: A View from the Southeastern United States. In *Early Paleoindian Economies of Eastern North America*, edited by Kenneth Tankersley and Barry Isaac, 163–216. Research in Economic Anthropology Supplement 5.

Anderson, David G., D. Shane Miller, Derek T. Anderson, Stephen J. Yerka, J. Christopher Gillam, Erik N. Johanson, and Ashley Smallwood
2009 Paleoindians in North America: Evidence from PIDBA (Paleoindian Database of the Americas). Poster presented at the Annual Meeting of the Society for American Archaeology, Atlanta, Georgia, April 24, 2009.

Anderson, David G., Thaddeus G. Bissett, and Stephen J. Yerka
2014 The Late-Pleistocene Human Settlement of Interior North America: The Role of Physiography and Sea-Level Change. In *Paleoamerican Odyssey,* edited by Kelley E. Graf, Caroline V. Ketron, and Michael R. Waters, pp. 183–203. Texas A&M University Press, College Station.

Anderson, David G., Albert C. Goodyear, James Kennett, and Allen West
2011 Multiple Lines of Evidence for Possible Human Population Decline/Settlement Reorganization during the Early Younger Dryas, *Quaternary International* 242:570–583.

Anderson, David G., David Echeverry, D. Shane Miller, Stephen J. Yerka, Eric Kansa, Sarah Whitcher Kansa, Kelsey Noack Myers, Joshua J. Wells, Thaddeus G. Bissett, Christopher R. Moore, Ashley M. Smallwood, and Andrew A. White
2019 Paleoindian Settlement in the Southeastern United States: The Role of Large Databases. In *Early Floridians: New Directions in the Search for and Interpretation of Florida's Earliest Inhabitants*, edited by David Thulman and Irv Garrison, 241–275. University Press of Florida, Gainesville.

Anderson, David G., and Glen T. Hanson
1988 Early Archaic Settlement in the Southeastern United States: A Case Study from the Savannah River Valley. *American Antiquity* 53(2):262–286.

Anderson, David G., and Kenneth E. Sassaman
1996 *The Paleoindian and Early Archaic Southeast.* University of Alabama Press, Tuscaloosa .
2007 Mid-Holocene Cultural Dynamics in Southeastern North America. In *Climate Change and Cultural Dynamics: A Global Perspective on Mid-Holocene Transitions,* edited by David G. Anderson, Kirk A. Maasch, and Daniel H. Sandweiss. Elsevier, 457–489.

Anderson, David G., and Steven D. Smith
2003 *Archeology, History and Predictive Modeling: Research at Fort Polk, 1972–2002.* University of Alabama Press, Tuscaloosa.

Anderson, Gary C.
1999 *The Indian Southwest, 1580-1830: Ethnogenesis and Reinvention*. University of Oklahoma Press, Norman.

Anderson, John B., K. Abdulah, S. Sarzalejo, F. Siringan, and M. A. Thomas
1996 Late Quaternary Sedimentation and High-Resolution Sequence

Stratigraphy of the East Texas Shelf. *Geol. Soc. Spec. Publ.* 117:95–124.

Anderson, John B., A. Rodriguez, K. C. Abdulah, R. H. Fillon, L. A. Banfield, H. A. McKeown, and J. S. Wellner
2004 Late Quaternary Stratigraphic Evolution of the Northern Gulf of Mexico: A Synthesis. In L*ate Quaternary Stratigraphic Evolution of the Northern Gulf of Mexico Margin*, edited by J. B. Anderson and R. H. Fillon, pp. 1–24. Special Publication 79, Society of Sedimentary Research.

Anderson, John B., and A. B. Rodriguez (editors)
2008a *Response of Upper Gulf Coast Estuaries to Holocene Climate Change and Sea-Level Rise*. Special Paper 443, Geological Society of America.

Anderson, John B., A. T. Rodriguez, K. T. Milliken, and M. Taviani
2008b The Holocene Evolution of the Galveston Estuary Complex, Texas: Evidence for Rapid Change in Estuarine Environments. In. *Response of Upper Gulf Coast Estuaries to Holocene Climate Change and Sea-Level Rise*, edited by J. B. Anderson and A. B. Rodriguez, pp. 89–104. Special Paper 443, Geological Society of America.

Anderson, John B., D. J. Wallace, A. R. Simms, A. B. Rodriguez, and K. T. Milliken
2014 Variable Response of Coastal Environments of the Northwestern Gulf of Mexico to Sea-Level Rise and Climate Change: Implications for Future Change. *Mar. Geol.* 352:348–366.

Anderson, John B., D. J. Wallace, A. R. Simms, A. B. Rodriguez, R. W. R. Wright, and Z. Patrick Taha
2016 Recycling Sediments between Source and Sink during a Eustatic Cycle: Systems of Late Quaternary Northwestern Gulf of Mexico Basin. *Earth Science Reviews* 153:111–138.

Anschuetz, K. F., R. H. Wilshusen, and C. L. Scheick
2001 An Archaeology of Landscapes: Perspectives and Directions. *Journal of Archaeological Research* 9(2):157–211.

Arber, Edward (editor)
1910 *Travels and Works of Captain John Smith 1580–1631.*, vol. 1, new edition by A. G. Bradley. Edinburgh, 1910 [Arber quotes H. Spelman, 1609, *Relation of Virginia.* A version of Spelman's text in modern English is available, along with many other primary materials, at the Virtual Jamestown project's "First Hand Accounts of Virginia, 1575-1705." http://www.iath.virginia.edu/vcdh/jamestown/fhaccounts_date.html.]

Arnn, John W. III
2012 Defining Hunter-Gatherer Sociocultural Identity and Interaction at a Regional Scape: The Toyah/Tejas Social Field.In *The Toyah Phase of Central Texas: Late Prehistoric Economic and Social Processes*, edited by Nancy A. Kenmotsu and Douglas Boyd, 44–75. College Station: Texas A&M University Press.

Arricivita, Juan Domingo
1792 *Crónica seráfica y apostólica del colegio de Propaganda Fide de la Santa Cruz de Querétaro en la Nueva España*. Mexico City. Available online from GoogleBooks.

Ashley, Keith H.
2005 Archeology Review of Mt. Royal. *The Florida Anthropologist*, vol. 58(3-4): 265-286.

Atakapa-Ishak Nation
2019 Atakapa Ishak Nation. www.atakapa-ishak.org, accessed June 2019.

Aten, Lawrence E.
1967 *Excavations at the Jameson Site, Liberty County, Texas*. Report 1, Houston Archeological Society.
1971 *Archeological Excavations at the Dow-Cleaver Site, Brazoria County, Texas*. Texas Archeological Salvage Project, Technical Bulletin no. 1, University of Texas at Austin.
1981 Determining Seasonality of *Rangia cuneata* from Gulf Coast Shell Middens: *Bulletin of the Texas Archeological Society* 52:179–200.
1983 *Indians of the Upper Texas Coast*. Academic Press, New York.

Aten, L. E. and C. N. Bollich
1969 A Preliminary Report on the Development of a Ceramic Chronology for the Sabine Lake Area of Texas and Louisiana. Bulletin of the Texas Archeological Society, San Marcos 40:241-258.

Aten, L. E., C. K. Chandler, A. B. Wesolowsky, and R. M. Malina
1976 Excavations at the Harris County Boys' School Cemetery. Special Report no. 3, Texas Archeological Society.

Aten, Lawrence E., and Carolyn Good
1984 Initial Geoarcheological Evaluation of the Texas City Channel Site (41GV81), Galveston County, Texas. In Minerals Management Service, *Proceedings of the Fifth Annual Gulf of Mexico Information Transfer Meeting*, New Orleans, November 27–29, 1984, 457–462. OCS Study MMS 85-0008.

Atkinson, Mary J.
1955 Will Houston's Ancient Bayou Monster Inspire a Museum? *Houston Chronicle Rotogravure Magazine*, May 22, 1955, 8–9.

Austin, Stephen F.
1821 Journal of Stephen F. Austin on His First Visit to Texas, 1821.*Quarterly of the Texas State Historical Association*7, no. 4 (April 1904):286–307.

Baker, William S., and Clarence H. Webb
1977 Catahoula Type Projectile Points. *Louisiana Archaeology* 3:225–251.

Balsillie, James H., and Joseph F. Donoghue
2004 *High Resolution Sea-Level History for the Gulf of Mexico Since the Last Glacial Maximum*. Report of Investigations no. 103, Florida Geological Survey.

Banks, L. D.
1990 *From Mountain Peaks to Alligator Stomachs: A Review of Lithic Sources for the Trans-Mississippi South, the Southern High Plains and Adjacent Southwest.* Memoir 4, Oklahoma Anthropological Society, Oklahoma City.

Barrett, Jason W.
2013 Data-Recovery Investigations at the Dimond Knoll Site (41HR796) (lecture). *The Profile* (Houston Archeological Society) 2(9):1.
2016 Finishing what we started: 2016 TAS field school.

http://www.txhas.org/field_school_2016_intro.html.
2018 Native American Trade Trails through Southeast Texas (lecture): *The Profile* (Houston Archeological Society) 8(5):1–2.

Barrett, Jason W., and Richard A. Weinstein
2014 Data Recovery Investigations and Public Outreach at the Dimond Knoll site (41HR796). Houston Archeological Society. www.txhas.org/articles.

Bartlett, John Russell
1854 *Personal Narrative of Explorations & Incidents in Texas, New Mexico, California, Sonora, and Chihuahua: Connected with the United States and Mexican Boundary Commission, During the Years 1850, '51, '52, and '53*, Vol. 2. G. Routledge, London.

Robert E. Bell
1980 Fourche Maline: An Archaeological Manifestation in Eastern Oklahoma. In *Caddoan and Poverty Point Archaeology: Essays in Honor of C. H. Webb.* Louisiana Archaeological Society, Lafayette.

Bement, L. C., E. L. Lundelius Jr., and R. A. Ketcham
2005 Hoax or History: A Bison Skull with Embedded Calf Creek Projectile Point. *Plains Anthropologist* 50:221–226.

Bement, L. C., R. D. Mandel, J. F. de La Tep, D. K. Uitey, and S. A. Turpin
1987 *Buried in the Bottoms: The Archeology of Lake Creek Reservoir, Montgomery County, Texas*. Research Report no. 97, Texas Archeological Survey.

Bement, Leland C., and Brian J. Carter
2010 Jake Bluff: Clovis Bison Hunting on the Southern Plains of North America. American Antiquity 75(4):907–933.

Bement, Leland C., Brian J. Carter, Polly Anna Jelley, Kristen Carlson, and Scott Fine
2012 Badger Hole: Towards Defining a Folsom Bison Hunting Complex along the Beaver River, Oklahoma. *Plains Anthropologist* 57(221):53–62.

Benedict, Shawn
2019 Personal communication. East Texas Forest Preserves Manager, The Nature Conservancy, Silsbee, Texas.

Bense, Judith A.
2016 *Archeology of the Southeastern United States: Paleoindian through World War I*. Routledge, New York.

Berlandier, Jean Louis
1969 [1830] *The Indians of Texas in 1830.* Edited by John C. Ewers. Smithsonian Institution Press, Washington, DC.

Berger, Eric
2004 Skull from Ice Age Mammoth Unearthed in Clute. *Houston Chronicle*, January 13, 2004.

Berryhill, Henry L. Jr., J. R. Suter, and Nancy S. Hardin
1986 *Late Quaternary Facies and Structure, Northern Gulf of Mexico: Interpretations from Seismic Data*. AAPG Studies in Geology no. 23.

Bever, Michael R., and David J. Meltzer
2007 Exploring Variation in Paleoindian Life Ways: The Third Revised Edition of the Texas Clovis Fluted Point Survey. *Bulletin of the Texas Archeological Society* 78:65–99.

Beverley, Robert Jr.
1705 *The History and Present State of Virginia*. Archived at the Library of Congress, Washington, DC.

Billings, Ronald F.
2014 *A Century of Forestry 1914–2014*:. *Texas Forestry Association and Texas A&M Forest Service*. Donning Company Publishers, Virginia Beach.

Birmingham, W. W., and J. A. Huebner
1991 Incised Bone and Conch Shell Artifacts from the Texas West Indies Site (41VT9). *La Tierra* 18(3):8–20.

Bissett, Thaddeus G., and Cheryl P. Claasen
2016 Portable X-ray Fluorescence in Sourcing Prehistoric Whelk Shell Artifacts: A Pilot Study from Eastern North America: *North American Archeologist* 37(3):143-169.

Black, W. Marshall
1951 1000 Years Ago in Houston. *Nature Notes from the Gulf States* (Houston Museum of Natural History), Spring 1951.
1985 Recollections of a New Member. *Houston Archeological Society Journal* 81:2–10.
1987 A Method of Estimating Numbers of Vessels Represented by Large Collections of Potsherds. *Houston Archeological Society Journal* 87: 1-11.
n.d. Miscellaneous unpublished field notes, Houston Archeological Society files.

Black, W. Marshall, L. W. Patterson, and Rebecca Story
1992 Burials with Marine Shell Goods at 41WH44, Wharton County, Texas. *Houston Archeological Society Journal* 102:20–24.

Black, Steve, Timothy W. Perttula, and Dee Ann Story
2003 The Caddo Ancestors. *Texas Beyond History* https://texasbeyondhistory.net/tejas/ancestors/early.html.

Black, Steve, and Michael Quigg
2006 Unstemmed Point Tradition. *Texas Beyond History*, https://texasbeyondhistory.net/st-plains/prehistory/images/unstemmed.html.

Blair, E. L.
1930 *Early History of Grimes County*. Privately published by the Superintendent of Public Schools, Trinity, Texas.

Blankenship, Beth
2013 The Hopewellian Influence at Crystal River, Florida: Testing the Marine Shell Artifact Production Hypothesis. Unpublished PhD dissertation, University of South Florida.

Block, W. T.
1976 A History of Jefferson County, Texas from Wilderness to Reconstruction. Unpublished Master's thesis, Lamar University, Beaumont.
1977 Southeast Texas Indian Homeland: The Burial Mounds of Old Port Neches: *Beaumont Enterprise*, June 30, 1977; reprinted February 5, 1984. www.wtblock.com/wtblockjr/indian.htm.

Blum, Michael D., and Andres Aslan
2006 Signatures of Climate vs. Sea-Level Change within Incised Valley-Fill Successions: Quaternary Examples

from the Texas Gulf Coast. *Sedimentary Geology* 190:177–211.

Blum, Michael D., J. Martin, K. Milliken, and M. Garvin
2006 Paleovalley Systems: Insights from Quaternary Analogs and Experiments. *Earth Science Reviews* 116: 144.

Bollaert, William
1956 [1842] *William Bollaert's Texas*. Edited by W. Eugene Hollon. University of Oklahoma Press, Norman.

Bolton, Herbert E.
1913 Spanish Activities on the Lower Trinity River, 1746–1771. *Southwestern Historical Quarterly*16(4)339–377.
1914 *Athanase de Mézières and the Louisiana-Texas Frontier, 1768–1780*. Arthur H. Clark Company, Cleveland, Ohio.
1970 [1915] *Texas in the Middle Eighteenth Century: Studies in Spanish Colonial History and Administration*. Reprint, University of Texas Press, Austin.

Bond, C. L.
1977 *An Archeological Assessment of the Gibbons Creek Steam Electric Station*. Report no. 36, Texas A&M Anthropology Laboratory.

Bossu, Jean Bernard
1962 [1768] *Nouveaux Voyages aux Indes Occidentales*. Edited by Seymour Feiler. University of Oklahoma Press, Norman. As quoted in Swanton 1946.

Bousman, C. Brett, Barry Baker, and Anne Kerr
2004 PaleoIndian Archeology in Texas. In *Archeology of Texas*, edited by Timothy K. Perttula. Texas A&M University Press, College Station.

Brickell, John
1737 *The Natural History of North Carolina*. James Carson, Dublin.

Brink, Jack W.
2008 *Imagining Head-Smashed-In: Aboriginal Buffalo Hunting on the Northern Plains*. Athabasca University Press, Edmonton.

Brink, Jack, and Bob Dawe
1989 *Final Report of the 1985 and 1986 Field Season at Head-Smashed-In Buffalo Jump, Alberta*. Manuscript Series No. 16, Archeological Survey of Alberta.

Broehm, Cory Julian, and Troy R. Lovata
2004 Five Corner Tang Bifaces from the Silo Site, 41KA102, a Late Archaic Mortuary Site in South Texas. *Plains Anthropologist* 49:189.

Broughton, Jack M., and Elic M. Weitzel
2018 Population Reconstructions for Humans and Megafauna Suggest Mixed Causes for North American Pleistocene Extinctions. *Nature Communications*, vol. 9, article no. 5441.

Brown, Andrew D.
2010 An Exploration of Turtle Shell Rattle Manufacture in the Mississippian Period. Department of Anthropology Senior Thesis, Middle Tennessee State University.

Brown, Dale M. (editor)
1992 *Mound Builders and Cliff-Dwellers*. Lost Civilizations Series, Time Life Books, New York.

Brown, James Alison
1996 *The Spiro Ceremonial Center: The Archaeology of Arkansas Valley Caddoan Culture in Eastern Oklahoma, Volume 1*. University of Michigan Press, Ann Arbor.

Brown, Kenneth M.
1993 Four Clovis Points from San Augustine County, Texas. *Index of Texas Archaeology*, Open Access Gray Literature from the Lone Star State, Vol. 1993, Article 22.
2012 "McFaddin Beach: This Site Is All Washed Up!" *Texas Beyond History*, www.texasbeyondhistory.net/mcfaddin.

Brown, Robin C.
2014 *Florida's First People: 12,000 Years of Human History*: Rowman & Littlefield, Washington, DC.

Bruggeman, Jason E., P. J. White, Robert Garrott, and Fred G. Watson
2009 Partial Migration in Yellowstone Bison. In *The Ecology of Large Mammals in Central Yellowstone*, edited by P. J. White, Robert Garrott, and Fred G. Watson, 217–235. Elsevier, New York.

Bryant, V. M., and R. G. Holloway
1985 A Late-Quaternary Paleoenvironmental Record of Texas: An Overview of the Pollen Evidence. In *Pollen Records of Late-Quaternary North American Sediments*, edited by V. M. Bryant and R. G. Holloway, 54. American Association of Stratigraphic Palynologists, Calgary, Canada.

George Bryce
1893 The Assiniboine River and Its Forts. *Transactions of the Royal Society of Canada*, Section II, 69–78.

Buckley, S. B.
1874 First Annual Report of the Geological and Agricultural Survey of Texas, Austin.

Bushnell, David L. Jr.
1909 The Choctaw of Bayou Lacombe, St. Tammany Parish, Louisiana: Bulletin 48, Bureau of American Ethnology, Smithsonian Institution, Washington.
1927 *Drawings by A. DeBatz in Louisiana, 1732–1735*. Publication 2925, Smithsonian Miscellaneous Collections, vol. 80, no. 5, Washington, DC.

Byrd, Kathleen M.
1976 Tchefuncte Subsistence: Information Obtained from the Excavation of the Morton Shell Mound, Iberia Parish, Louisiana. Unpublished Master's thesis, Department of Geography and Anthropology, Louisiana State University, Baton Rouge.
1994 Tchefuncte Subsistence Practices at the Morton Shell Mound, Iberia Parish, Louisiana. *Louisiana Archeology* 16:1–128.

Campbell, T. N.
1952 The Kent-Crane Site: A Shell Midden on the Texas Coast. *Bulletin of the Texas Archeological and Paleontological Society* 3:39-77.
1960 Archeology of the Central and Southern Sections of the Texas Coast. *Bulletin of the Texas Archeological Society* 29 (for 1958):145–175.

Campbell, Thomas N.
2019 Coco Indians. *Handbook of Texas Online*, http://www.tshaonline.org/handbook/online/articles/bmc66, accessed May 10, 2019.

2020 Toyal Indians. *Handbook of Texas Online*, http://www.tshaonline.org/handbook/online/articles/bmt76, accessed August 12, 2020.

Campbell, T. N., and T. J. Campbell
1981 *Historic Indian Groups of the Choke Canyon Reservoir and Surrounding Areas, Southern Texas*. Choke Canyon Series 1, Center for Archeological Research, University of Texas at San Antonio.

Carlisle, Jeffrey D.
2010 Tonkawa Indians. *Handbook of Texas Online*, Texas State Historical Association, www.tshaonline.org/handbook/entries/tonkawa-indians, accessed April 2020.

Carlson, A. E.
2013 The Younger Dryas Climate Event. In *Encyclopedia of Quaternary Science*, vol. 3, 126–34. Elsevier, New York.

Carlson, Kristen
2015 The Development of Paleoindian Communal Bison Kills: A Comparison of Northern to Southern Plains Arroyo Traps. Unpublished PhD Dissertation, University of Oklahoma, Norman.

Carlson, Kristen, and Leland C. Bement
2018 *The Archeology of Large Scale Manipulation of Prey: The Economics and Social Dynamics of Mass Hunting.* University Press of Colorado, Louisville, Colorado.

Carpenter, M. D.
1846 Remarks on Some Fossil Bones Recently Brought to New Orleans from Tennessee and from Texas. *American Journal of Science and the Arts* (New Haven, Connecticut), no. II, pp. 244–249.

Carpenter, Steve, and Kevin Miller
2007 McKinney Roughs. *Texas Beyond History*, https://texasbeyondhistory.net/mckinney/index.html.

Carpenter, S., and P. Paquin
2010 Toward a Genealogy of Texas Stone Projectile Points. *Bulletin of the Texas Archeological Society* 81:153–175.

Carr, Christopher, and D. Troy Case
2006 *Gathering Hopewell: Society, Ritual, and Ritual Interaction*. Springer Science and Business Media, Berlin.

Carr, Christopher, Rex Weeks, and Mark Bahti
2008 The Functions and Meanings of Ohio Hopewell Ceremonial Artifacts in Ethnohistorical Perspective. Chapter 11 in *The Scioto Hopewell and Their Neighbors: Bioarcheological Documentation and Cultural Understanding*, edited by D. Troy Case and Christopher Carr, 501–521. Springer, New York.

Carroll, Benejah Harvey
1912 *Standard History of Houston from the Original Sources.* H. W. Crew, Knoxville, Tennessee.

Carson, David
2018 *The Account of Cabeza de Vaca: A Literal Translation with Analysis and Commentary*. Living Water Specialties, Friendswood, Texas.
2019a Identifying the Isla de Malhado. In *The Discovery of Texas*, http://www.texascounties.net/articles/discovery-of-texas/islademalhado.htm.
2019b Interpreting the Territories of the Coastal Natives Described by Cabeza de Vaca. In *The Discovery of Texas*, http://www.texascounties.net/articles/discovery-of-texas/cabezadevaca-coastalnatives.htm#note10, updated January 9, 2019.

Case, D. Troy, and Christopher Carr (editors)
2008 *The Scioto Hopewell and Their Neighbors: Bioarcheological Documentation and Cultural Understanding*. Springer, New York.

Catalog of Life
2020 Taxonomic information on species, entries on *Busycon Perversum* and *Busycon contrarium*.Published by Catalog of Life Partnership, www.gbif.org.

Catlin, George
1844 *Letters and Notes on the Manners, Customs, and Conditions of North American Indians*, Letter no. 2, Chapter 33, published in London. www.user.xmission.com.
n.d. *Prairie Meadows Burning* (oil painting, catalog description: "PRAIRIE MEADOWS BURNING, on the bank of the upper Missouri, the buffaloes and white wolves escaping from the flames.) Ca. 1861–1869, drawn from his 1832 visit to the Great Plains. Paul Mellon Collection, National Gallery of Art, Washington, DC.

Chapman, Carl
1980 *The Archeology of Missouri*, vol. 2. University of Missouri Press, Columbia.

Chipman, Donald E.
2010 Cabeza de Vaca, Alvar Nunez. *Handbook of Texas* Online, Texas State Historical Association, www.tshaonline.org/handbook/entries/cabeza-de-vaca-lvar-nunez, accessed 2019.

Chitimacha Tribe
2020 Chitimacha Baskets. Chitimacha tribal website, www/chitimacha.gov/history-culture/chitimacha-baskets.

Church, J. A., and N. J. White
2011 Sea-Level Rise from the Late 19th to the Early 21st Century. Surveys in *Geophysics* 32:585–602.

Clark, John W. Jr.
1988 Results of Testing at Site 41GM23, Grimes County, Texas. Texas Department of Highways and Public Transportation, Highway Design Division, 28p. Online at Scholarworks, Stephen F Austin University.

Clark, Peter U., Arthur S. Dyke, Jeremy D. Shakun, Anders E. Carlson, Jorie Clark, Barbara Wohlfarth, Jerry X. Mitrovica, Steven W. Hostetler, and A. Marshall McCabe
2009 The Last Glacial Maximum. *Science* 325:710–714.

Clarke, Fannie McAlpine
1905 A Chapter in the History of a Young Territory. *Quarterly of the Texas State Historical Association* 9(1):51–62.

Claassen, Cheryl
1996 A Consideration of the Social Organization of the Shell Mound Arcahic. In *Archaeology of the Mid-Holocene Southeast*, edited by Kenneth A. Sassaman and David G. Anderson, 235–258. University Press of Florida, Gainesville.

Claassen, Cheryl, and Samuella Sigmann
1993 Sourcing Busycon Artifacts of the Eastern United States. *American Antiquity*58(2):333–347.

Clopper, Edward N.
1950 *An American Family: Its Ups and Downs through Eight Generations from 1650 to 1880*. Privately published, Cincinnati, Ohio.

Coleman, J. M., and H. H. Roberts
1988 Sedimentary Development of the Louisiana Continental Shelf Related to Sea Level Cycles: Part II—Seismic Response. *Geo-Mar. Lett.* 8:109–119.

Coleman, J. M., H. H. Roberts, and G. W. Stone
1998 Mississippi River Delta: An Overview. *Journal of Coastal Research* 14:698–716.

Collins, Michael B.
1995 Forty Years of Archeology in Central Texas. *Bulletin of the Texas Archeological Society* 66:36–400.
2004 Archeology in Central Texas. In *The Prehistory of Texas*, edited by Tmothy K. Perttula, 101–126. Texas A&M University Press, College Station.
2007 Discerning Clovis Subsistence from Stone Artifacts and Site Distributions on the Southern Plains Periphery. In *Foragers of the Terminal Pleistocene in North America*, edited by Renee B. Walker and Boyce N. Driskell, 59–87. University of Nebraska Press, Lincoln.
2011 Heated Rocks as Evidence of Prehistoric Hunter-Gatherer Adaptations in Texas. *Bulletin of the Texas Archeological Society* 82:181.

Collins, Michael B., Gail L. Bailey, C. Britt Bousman, Susan W. Dial, Paul Goldberg, Jam Guy, Vance T. Holliday, C. E. Mear, and Paul R. Takac
1998 Wilson-Leonard, An 11,000-year Archeological Record of Hunter-Gatherers in Central Texas Volume I: Introduction, Background, and Syntheses. Index of Texas Archaeology, Open Access Gray Literature from the Lone Star State Article 24, Vol. 1998.

Collins, Michael B., David Yelacic, and Britt Bousman
2011 "Realms": A Look at Paleoclimate and Projectile Points in Texas. *Bulletin of the Texas Archeological Society* 82:3–30.

Connan, J.
1999 Use and Trade of Bitumen in Antiquity and Prehistory: Molecular Archaeology Reveals Secrets of Past Civilizations. *Philosophical Transactions Royal Society of London, Biological Sciences* 354:33–50.

Connaway, John M.
1977 *The Denton Site, a Middle Archaic Occupation in the Northern Yazoo basin, Mississippi*. Mississippi Department of Archaives and History, Jackson.

Converse, Robert N.
1979 *The Glacial Kame Indians*. Archaeological Society of Ohio, Columbus, Ohio.

Copas, Wesley J.
1984 Preliminary Report on the Analysis of Human Skeletal Remains from the Peikert Site (41WH14), Wharton County, Texas. *Houston Archological Society Journal*79:1–7.

Cordova, Carlos E., and William Johnson
2019 An 18ka to Present Pollen- and Phytolith-Based Vegetation Reconstruction from Hall's Cave, South-Central Texas, USA. *Quaternary Research*, May 2019, 1–22.

Covey, C. (editor)
1983 *Cabeza de Vaca's Adventures in the Unknown Interior of America*. Univ. of New Mexico Press, Albuquerque.

Cronon, William
1983 *Changes in the Land: Indians, Colonists, and the Ecology of New England*. Hill and Wang, New York.

Cox, Kim A., and Herman A. Smith
1988 Kent-Crane Revisited. *La Tierra* 15(3): 24–38.

Crook, Wilson W. Jr.
1959 C-14 Date for Late Carrollton Focus Archaic Level: 6,000 Years B.P. *Oklahoma Anthropological Society Newsletter* 8(3):1–2.

Crook, Wilson W. Jr., and R. King Harris
1952 Trinity Aspect of the Archaic Horizon: The Carrollton and Elam Foci. *Bulletin of the Texas Archeological and Paleontological Society* 23:7–38.

Crook, Wilson W. III
2017a New Clovis Discoveries from the Wood Springs Site (41LB15), Liberty County, Texas. *Newsletter of the Friends of the Texas Archeological Research Laboratory*, September, 5, 11.
2017b The First Reported Occurrence of Clovis Artifacts from Liberty County, Texas. *Bulletin of the Texas Archeological Society* 88:157–169.
2018 The Occurrence of Carrollton Phase Archaic Materials in Southeast Texas. In *Neither Snow, Nor Rain, Nor Heat, Nor Dark of Night, Shall Stay These Couriers: Essays Honoring Jay C. Blaine*, edited by S. Alan Skinner and Molly A. Hall, 87–96. Texas Archeological Society.
2019a A Broken Boatstone from the Savoy Site (41LB27), Liberty County, Texas. *Houston Archeological Society Journal* 141:47–52.
2019b A Broken Bannerstone from the Wood Springs Site (41LB15), Liberty County, Texas. *Houston Archeological Society Journal* 141:41–46.
*The Carrollton Phase Archaic: A Redefinition of the Chronology, Composition, and Aerial Distribution of the Early Archaic Horizon along the Trinity River, Texas.* Report no. 35, Houston Archeological Society.
2020b Liberty County: A Major Trade Entrepot for Southeast Texas. *The Profile* (Houston Archeological Society) 9(9):1.

Crook, Wilson W. III, and August G. Costa
2019 Two Bannerstones from the Savoy Site (41LB27), Liberty County, Texas. *Houston Archeological Society Journal* 141:35–39.

Crook, Wilson W. III, and Mark D. Hughston
2007 The East Fork Biface: A New Distinctive Artifact from North Central Texas. *The Record* (Dallas Archeological Society) 55(2):58–64.
2015 *The East Fork Late Prehistoric: A Redefinition of Cultural Landscapes Along the East Fork of the Trinity River, North Central Texas*. Createspace (now Kindlebooks).

Crook, Wilson W. III, Lenore A. Psencik, Linda C. Gorski, and Thomas L. Nuckols

2016 *The Timber Fawn Clovis Site (41HR1165): An Early Paleoamerican Occupation in Kingwood, Harris County, Texas*. Report 26, Houston Archeological Society.

Crook, Wilson III, Robert J. Sewell, Linda C. Gorski, and Louis F. Aulbach
2017 *The Andy Kyle Archeological Collection, Sam Houston Regional Library and Research Center, Liberty, Texas*. Report no. 29, Houston Archeological Society.

Cunningham, Wilbur M.
1948 *A Study of the Glacial Kame Culture in Michigan, Ohio, and Indiana, with an Appendix by James B. Griffin*.University of Michigan Press, Ann Arbor.

Cushing, Frank Hamilton
1896 Exploration of Ancient Key Dwellers' Remains on the Gulf Coast of Florida. *Proceedings of the American Philosophical Society* 3:329–448.

Daigle, Jerry J., Glenn E. Griffith, James M. Omernik, Patricia L. Faulkner, Richard P. McCulloh, Lawrence R. Handley, Latimore M. Smith, and Shannen S. Chapman
2019 Ecosystems of Louisiana, Levels 3 and 4. Environmental Protection Agency, https://www.epa.gov/eco-research/ecoregion-download-files-state-region-6.

Darnell, Rezneat Milton
2015 *The American Sea: A Natural History of the Gulf of Mexico*. Texas A&M University Press, College Station.

Davis, Anna L.
1925 Old Montgomery. *Dallas Morning News*, December 3, 1925. As quoted by Blair 1930.

Davis, M.
1981 Archaeological Testing, 41GM57, 41GM58, and 41GM83, TMPA Gibbons Creek Project. Document 81470, Espey, Huston and Associates.

Davis, L. G.
2011 The North American Paleocoastal Concept Reconsidered. In *Trekking the Shore: Changing Coastlines and the Antiquity of Coastal Settlement*, edited by N. F. Bicho, J. A. Haws, and L. G. Davis, 3–26. Springer, New York.

De Bry, Theodor, Carolus Clusius, John Witte, and Thomas Harriot
1590 *Admiranda narratio, fida tamen, de commodis et incolarvm ritibvs Virginiae*. Original in Yale University Library.

DeConto, R. M., and D. Pollard
2016 Contribution of Antarctica to Past and Future Sea-Level Rise. *Nature* 531:591–597.

DeMasi, Natalie
2013 Refining Point Types in Southwest Mississippi. Honors thesis, Archeology, University of North Carolina at Chapel Hill.

Denevan, William M.
1992 The Pristine Myth: The Landscape of the Americas in 1492. In *The Americas before and after 1492: Current Geographical Research, Annals of the Association of American Geographers* 82 (3):369–385.

Des Lauriers, M. R.
2010 *Island of Fogs: Archeological and Ethnohistorical Investigations of Isla Cedros, Baja California*. University of Utah Press, Salt Lake City.

Dial, Susan
2015 A Masterpiece in Stone. TARL Blog, www.sites.utexas.edu/tarl/2015/03/17/a-masterpiece-in-stone.

Dial, Susan, and Steve Black (editors)
2015 Native Peoples of the Coastal Prairies and Marshlands in Early Historic Times. *Texas Beyond History*, www.texasbeyondhistory.net/coast/peoples/index.html,accessed August 2015.

Dial, S. W., A. K. Kerr, and M. B. Collins
1998 Projectile Points. In *Wilson-Leonard: An 11,000- Year Archeological Record of Hunter-Gatherers in Central Texas*, Vol. 2: *Chipped Stone Artifacts*, edited by M. B. Collins, 313–445. Studies in Archeology 31, Texas Archeological Research Laboratory, University of Texas at Austin, and Report 10, Archeology Studies Program, Environmental Affairs Division, Texas Department of Transportation, Austin.

Dibble, D. S.
1968 Part I: Archeology. In *Bonfire Shelter: A Stratified Bison Kill Site, Val Verde County, Texas*, by David S. Dibble and Dessamae Lorrain. Miscellaneous Papers no. 1, Texas Memorial Museum, Austin.

Dickens, William A.
1984 A Buffalo Kill Site in Harris County, Texas. *Central States Archeological Journal* 31(1):16–18.

Dillehay, Tom D.
1974 Late Quaternary Bison Population Changes on the Southern Great Plains. *Plains Anthropologist* 19(65):180–196.
2015 Entangled Knowledge: Old Trends and New Thoughts in First South American Studies. In *PaleoAmerican Odyssey*, edited by K. Graf, C. Ketron, and M. Waters, 377–396. Center for the Study of First Americans and Texas A&M University Press, College Station.
2019 Comments and Discussion. In *People and Culture in Ice Age Americas: New Dimensions in Paleoamerican Archeology*, edited by Rafael Suárez and Ciprian F. Ardelean, 244–256. University of Utah Press, Salt Lake City.

Dillehay, Tom D., C. Ramírez, M. Pino, M. B. Collins, J. Rossen, and J. D. Navarro
2008 Monte Verde: Seaweed, Medicine, and the Peopling of South America. *Science* 320:784–786.

Dillehay, Tom D., Carlos Ocampo, José Saavedra, Andre Oliveira Sawakuchi, Rodrigo M. Vega, Mario Pino, Michael Collins, et al.
2015 New Archeological Evidence for an Early Human Presence at Monte Verde, Chile. *PLos One*, vol. 10, no. 11.

Dillehay, Tom D., Steve Goodbred, Mario Pino, Victor F. Vásquez Sánchez, Teresa Rosales Tham, James Adocasio, Michael B. Collins, Patricia Netherly, Christine Hastorf, Katherine Chiou, Dolores Piperno, Isabel Rey, and Nancy Velchoff
2017 Simple Technologies and Diverse Food Strategies of the Late Pleistocene and Early Holocene at Huaca Prieta, Coastal Peru. *Science Advances* 3(5).

Dockall, John E., and Steve Black
2006 Morhiss Mound. *Texas Beyond History*, www.texasbeyondhistory.net.

Dockall, Helen Danzeiser, and John E. Dockall
1996 The Shell Assemblage from Morhiss (41VT1), an Archaic Site on the West Gulf Coastal Plain. *Southeastern Archaeology* 15(2):211–229.

Dolan, Maria
2012 The Gruesome History of Eating Corpses as Medicine. *Smithsonian Magazine*, May 6, 2012.

Donaldson, William S., and Stanley Wortner
1995 The Hind Site and the Glacial Kame Burial Complex in Ontario. *Ontario Archeology* 59:5–95.

Dreiss, Meredith L.
2001 Marine Shell Ornaments, Icons and Offerings. http://www.texasbeyondhistory.net/coast/nature/images/shell-ornaments.html, accessed August 25, 2009.

Driver, David
2011 Camped Along the Creek: Data Recovery Excavations at Prehistoric Occupation Site 41HR991, Harris County, Texas. HCFCD Project K100-00-00-X028, Report of Investigations no. 563, Moore Archeological Consulting.

Duffen, William A.
1939 The Morhiss Mound, a South Texas Site and Some of Its Implications (Abstract). Annual Meeting of the Texas Archeological and Paleontological Society, Abilene, Texas, October 28, 1939. On file at the Texas Archeological Research Laboratory, Austin.

Du Pratz, Le Page
1763 *The History of Louisiana, or of the Western Parts of Virginia and Carolina, Containing a Description of the Countries that Lie on Both Sides of the River Mississippi*. Project Gutenberg EBook, available online.

Dutton, A., and N. Barlow
2019 What Do We Know about Last Interglacial Sea Level? *Pages Magazine* 27: 6–7.

Dyer, J. O.
1917 *The Lake Charles Atakapas (Cannibals), Period of 1817–1820*. Howard Memorial Library, New Orleans.

Dyke, Arthur S.
2004 An Outline of North America Deglaciation with Emphasis on Central and Northern Canada. In *Quaternary Glaciations: Extent and Chronology, Part 2*, edited by J. Ehlers and P. L. Gibbard, 373–424. Elsevier, Amsterdam.

Engelhart, S. E., B. P. Horton, and A. C. Kemp
2011 Holocene Sea Level Changes along the United States' Atlantic Coast. *Oceanography* 24: 70–79.

Ensor, H. Blaine
1990 Comments on Prehistoric Chronology Building in Southeast Texas. *Houston Archeological Society Journal* 98:1–11.

Ensor, H. Blaine, and David L. Carlson
1991 *Alabonson Road: Early Ceramic Period Adaptation to the Inland Coastal Prairie Zone, Harris County, Southeast Texas*. Report of Investigations no. 8, Archeological Research Laboratory, Texas A&M University.

Erickson, Ralph A., and L. V. Blade
1963 *Geochemistry and Petrology of the Alkalic Igneous Complex at Magnet Cove, Arkansas*. Geological Survey Professional Paper 425, U.S. Geological Survey.

Erlandson, Jon M., M. H. Graham, B. J. Bourque, D. Corbett, J. A. Estes, and R. S. Steneck
2007 The Kelp Highway Hypothesis: Marine Ecology, the Coastal Migration Theory, and the Peopling of the Americas. *Journal of Island and Coastal Archeology*2:161–174.

Erlandson, Jon M., Torben Rick, Amira Ainis, Todd Braje, Kristina Gill, and Leslie Reeder-Meyers
2019 Late Pleistocene Estuaries, Paleoecology and Humans on North America's Pacific Coast. *Antiquity* 93(372):1–5.

Evans, Amanda M.
2012 Out of Site but Not Out of Mind: Submerged Prehistoric Landscapes of the Northwestern Gulf of Mexico Outer Continental Shelf. PhD dissertation, Louisiana State University, Baton Rouge.

Everhart, Timothy
2020 The Case of the Caldwell Mound: A Woodland Period Mound in the Central Scioto River Valley. *Midcontinental Journal of Archaeology*, May 2020, 1–30.

Ewers, John C.
1973 The Influence of Epidemics on the Indian Populations and Cultures of Texas. *Plains Anthropologist* 18(60):104–115.

Eyles, Eric
2004 Prehistoric Shell Artifacts from the Apalachicola River Valley Area, Northwest Florida, Unpublished Master's thesis, University of South Florida, Tampa.

Favata, Matin A., and José B. Fernández
1993 *The Account: Álvar Núñez Cabeza de Vaca's Relación*. Arte Público Press, Houston, Texas. Available online at the Witliff Collections, Texas State University, www.exhibits.library.txstate.edu/cabeza.

Fields, R. C. (editor)
1988 *Cultural Resource Investigations along White Oak Bayou, Harris County, Texas*. Reports of Investigations no. 62, Prewitt and Associates, Austin.

Fladmark, K. R.
1979 Routes: Alternative Migration Corridors for Early Man in North America. *American Antiquity* 44(1):55–69.

Folmer, Henri
1940 De Bellisle on the Texas Coast. *Southwestern Historical Quarterly* 44:222.

Ford, James A.
1951 Greenhouse: A Troyville-Coles Creek Period Site in Avoyelles Parish, Louisiana. Anthropological Papers of the American Museum of Natural History, New York, vol. 44, part 1.

Ford, James A., and G. I. Quimby
1945 The Tchefuncte Culture, and Early Occupation of the Lower Mississippi Valley. No. 2, Memoirs of the Society for American Archeology,

and Louisiana State University Press, Menasha, Wisconsin.

Ford, James A., and Clarence H. Webb
1956 Poverty Point, a Late Archaic Site in Louisiana. Anthropological Papers of the American Museum of Natural History, New York, vol. 46, part 1.

Foster, William C.
1995 *Spanish Expeditions into Texas 1689–1768*. University of Texas Press, Austin.
1998 *The La Salle Expedition to Texas: The Journal of Henri Joutel, 1684–1687*. Texas State Historical Association Press, Austin.

Gagliano, Sherwood
1967 *Cultural Resources Evaluation of the Northern Gulf of Mexico Continental Shelf*. Prepared for National Park Service by Coastal Environments, Baton Rouge, Louisiana.

Gallaway, Alecya
2011 The State of the Bay, The Human Role. Chapter 3 in *The State of the Bay*, Galveston Bay Estuary Program, Houston.

Galm, Jerry R.
1984 Arkansas Valley Caddoan Formative: The Wister and Fourche Maline Phases. In *Prehistory of Oklahoma*, edited by R. E. Bell, 199–219. Academic Press, New York.
n.d. Wister Phase. In *The Encyclopedia of Oklahoma History and Culture*, https://www.okhistory.org/publications/enc/entry.php?entry=WI032.

Gandy, William H.
1952 A History of Montgomery County, Texas. Unpublished Master's thesis, University of Houston.

Garvin, M. G.
2008 Late Quaternary Geochronologic, Stratigraphic, and Sedimentologic Framework of the Trinity River Incised Valley, East Texas Coast. Unpublished Master's thesis, Louisiana State University, Baton Rouge.

Gatschet, Albert S.
1891 *The Karankawa Indians, the Coast People of Texas*. Peabody Museum of American Archaeology and Ethnology, Cambridge, Massachusetts.

Gatschet, Albert S., and John R. Swanson
1932 *A Dictionary of the Atakapa Language, Accompanied by Text Material*. Bulletin 108, Bureau of American Ethnology, Washington, DC.

Geiser, S. W.
1945 Collectors of Pleistocene Vertebrates in Early Texas, I: William P. Huff (1811–1886). *Field and Laboratory* (Southern Methodist University Press, Dallas), 13(2):53–60.

Gertjejansen, Doyle J., J. Richard Shenkel, and Jesse O. Snowden
1983 Laboratory Simulation of Tchefuncte Period Ceramic Vessels from the Pontchartrain Basin, with Discussions Regarding Clay Chemistry and Mineralogy. *Southeastern Archaeology* 2:37–63.

Gibeaut, J. C., R. Gutierrez, R. Waldinger, W. A. White, T. L. Hepner, R. C. Smyth, J. R. Andrews, and M. Crawford
2006 The Texas Shoreline Change Project. http://www.beg.utexas.edu/coastal/coastal01.htm.

Gibson, Jon L.
1974 The Tchefuncte Culture in the Bayou Vermilion Basin, South Central Louisiana: Developmental Case Study. *Texas Archeological Society Bulletin* 45:67–95.
1990 Lower Mississippi Valley Exchange at 1100 B.C. In *Exchange in the Lower Mississippi Valley and Contiguous Areas in 1100 B.C.*, edited by J. L. Gibson, 1–7. Vol. 17, Bulletin of the Louisiana Archaeological Society, Baton Rouge.
1995 Swamp Exchange and the Walled-Mart: Poverty Point's Rock Business. In *Raw Materials and Exchange in the Mid-South*, Archeological Report no. 29, Mississippi Department of Archives and History, Baton Rouge.
2000 *The Ancient Mounds of Poverty Point Place of Rings*. University Press of Florida, Gainesville.
2010 Poverty Point Redux. In *Archeology of Louisiana*, edited by Mark Rees, 77–96. Louisiana State University Press, Baton Rouge.

Gibson, Jon L., and Mark A. Melancon
2004 In the Beginning: Social Contexts of First Pottery in the Lower Mississippi Valley. In *Early Pottery: Technology, Function, Style, and Interaction in the Lower Southeast*, edited by Rebecca Saunders and Christopher T. Hays, 169–192. University of Alabama Press, Tuscaloosa.

Gilmore, Melvin R.
1923 Arikara Order of Butchering a Buffalo. Gilmore papers, American Indian Studies Research Institute, Indiana University, Bloomington.

Girard, Jeffrey S.
2010 Caddo Communities of Northwest Louisiana. In, *Archeology of Louisiana*, edited by Mark Rees, 195–210. Louisiana State University Press, Baton Rouge.

Girard, Jeffrey S., Charles R. McGimsey, and Dennis Jones
2018 *Louisiana's Comprehensive Archeological Plan*. Division of Archeology, State of Louisiana, https://www.crt.state.la.us.

Girard, Jeffrey S., and Charles R. McGimsey
2019 Current Research: Discovery and Recovery of a 14th Century Dugout Canoe on the Red River, Caddo Parish, Louisiana. *Index of Texas Archaeology*, Open Access Gray Literature from the Lone Star State, Vol. 2019, Article 5.

Goad, S. I.
1980 Patterns of Late Archaic Exchange. *Tennessee Anthropologist* 5(1):1–16.

Golledge, N., D. Kowalewski, T. Naish, R. Levy,C. Fogwill, E. and Gasson
2015 The Multi-Millennial Antarctic Commitment to Future Sea-Level Rise. *Nature* 526:421– 425.

Graf, Kelly E.
2014 Siberian Odyssey. In *Paleoamerican Odyssey*, edited by Kelley E. Graf, Caroline V. Ketron, and Michael R. Waters, 65–80. Texas A&M University Press, College Station.

Graf, Kelly E., and Ian Buvit
2017 Human dispersal from Siberia to Beringia: Assessing a Beringian Standstill in Light of Archeological Evidence. *Current Anthropology* 58, Supplement 17:S583–S603.

Graves, Adam
2010 Investigation Resource Structure and Human Mobility: An Example from Folsom-Aged Bison Kill Sites on the

U.S. Southern Great Plains. Unpublished PhD dissertation, Department of Anthropology, University of Oklahoma, Norman.

Green, James A., Jr
1989 Calcasieu point: a formal description. *Louisiana Archeological Society Newsletter* 16(3):6–7.

Gremillion, Trent
2019 Alligator Effigy. *American Press* (Lake Charles, Louisiana), May 26, 2019.

Griffin, J. B.
1967 Eastern North American Archaeology: A Summary. *Science* 156(3772):175–191.

Gunnerson, James H.
1987 *Archaeology of the High Plains*. United States Forest Service, Denver.

Gustavson, Thomas C., and Graeme R. Bullen
1996 Sand and Gravel Mining in the Brazos River: An Assessment of Erosion Potential and Economic Impact. Publication CR1996, Bureau of Economic Geology, University of Texas, Austin.

Haas, Mary R.
1966 Historical Linguistics and the Genetic Relationship of Languages. In *Current Trends in Linguistics*, vol. 3: *Theoretical Foundations*, edited by Thomas A. Sebeok, 113–154. Mouton, The Hague.

Haley, Boyd R.
1993 *Geologic Map of Arkansas*. U.S. Geological Survey.

Hall, Grant D.
1981 *Allens Creek: A Study in the Cultural Prehistory of the Lower Brazos River Valley, Texas*. Research Report 61, Texas Archeological Survey, University of Texas at Austin.

Hall, S. A., and S. Valastro
1995 Grassland Vegetation in the Southern Great Plains during the Last Glacial Maximum. *Quat. Res.* 44:237– 245.

Halligan, Jessi J., M. R. Waters, A. Perrotti, I. J. Owens, J. M. Feinberg, M. D. Bourne, B. Fenerty, B. Winsborough, D. Carlson, D. C. Fisher, T. W. Stafford Jr., and J. S. Dunbar
2016 Pre-Clovis Occupation 14,550 Years Ago at the Page-Ladson Site, Florida, and the Peopling of the Americas. *Science Advances* 2(5), e1600375.

Hammett, Julia E.
1992 The Shapes of Adaptation: Historical Ecology of Anthopogenic Landscapes in the Southeastern United States. *Landscape Ecology* 7(2):121–135. SPB Academic Publishing, The Hague.

Harrington, H. R
1920 *Certain Caddo Sites in Arkansas*. Indian Notes and Monographs, Museum of the American Indian, New York.

Harris, Dilue Rose
1900 Reminiscences of Mrs. Dilue Harris. *Quarterly of the Texas State Historical Association*vol. 4 (October 1900–January 1901); vol. 7 (January 1904).

Hart, Richard H.
2001 Where Buffalo Roamed—or Did They? *Great Plains Research* II(I):83–102.

Hatcher, Mary Austin (translator)
1919 Juan Antonio Padilla's *Report on the Barbarous Indians of the Province of Texas*. *Southwestern Historical Quarterly* 23(1):47–68.

Hay, O. P.
1924 *The Pleistocene of North America and Its Vertebrated Animals from the States East of the Mississippi River and from the Canadian Provinces East of Longitude 95°*. Carnegie Institution, Washington, DC.

Hays, Christopher T., and Richard A. Weinstein
2004 Early Pottery at Poverty Point, Origins and Functions. In *Early Pottery: Technology, Function, Style, and Interaction in the Lower Southeast*, edited by Rebecca Saunders and Christopher T. Hays, 150–168. University of Alabama Press, Tuscaloosa.
2010 Tchefuncte and Early Woodland. In *Archeology of Louisiana*, edited by Mark Rees, 97–119. Louisiana State University Press, Baton Rouge.

Helm, Mary Sherwood, and Elias R. Wightman
1884 *Scraps of Texas History*: E. R. Warner and Company, Texas.

Hester, Thomas R.
1980 A Survey of Paleo-Indian Archeological Remains along the Texas Coast. In *Papers on the Archeology of the Gulf Coast*, pp. 1–11. Special Report no. 11, Center for Archeological Research, University of Texas at San Antonio,.

Hester, Thomas R., Michael B. Collins, Dee Ann Story, Ellen S. Turner, Paul Tanner, Kenneth M. Brown, Larry D. Banks, Dennis Stanford, and Russell J. Long
1992 Paleoindian Archaeology at McFaddin Beach, Texas. *Current Research in the Pleistocene* 9:20–22.

Hester, Thomas R., and Frederick Ruecking Jr.
1969 Additional Materials from the Ayala Site, a Prehistoric Cemetery Site in Hidalgo County, Texas. *Bulletin of the Texas Archeological Society* 40:147–157.

Hickerson, Nancy P.
2020 Jumano Indians. *Handbook of Texas Online*, https://www.tshaonline.org/handbook/entries/jumano-indians, accessed August 28, 2020.

Himmel, Kelly F.
1999 *The Conquest of the Karankawas and the Tonkawas*: Texas A&M University Press, College Station.

Hirst, K. Kris
2018 Fish Weir: Ancient Fishing Technology: A Tool of Subsistence Farmers for 8000 Years or more. ThoughtCo online journal, https://www.thoughtco.com/fish-weir-ancient-fishing-tool-170925.

Hockett, Bryan,
2009 13,000 Years of Large Game Hunting in the Great Basin. In *Past, Present and Future Issues in Great Basin Archaeology: Papers in Honor of Don D. Fowler*, edited by Bryan Hocket, 169–204. Cultural Resource Series no. 20, U.S. Department of the Interior, Bureau of Land Management.

Hodge, Frederick Webb
1907 *Handbook of American Indians North of Mexico.* 2 vols. Smithsonian Institute, Bureau of American Ethnology.

Holley, Mary Austin
1836 *Texas*. J. Clarke, Lexington, Kentucky; reprint, 1935, Steck, Austin.

Holmes, Charles E.
2011 The Beringian and Transitional Periods in Alaska: Technology of the East Beringian Tradition as Viewed from Swan Point. In *From the Yenisei to the Yukon: Interpreting Lithic Assemblage Variability in Late Pleistocene/Early Holocene Beringia*, edited by T. Goebel and Ian Buvit, 179–191. Texas A&M University Press, College Station.

Holmes, William H.
1883 Art in Shell of the Ancient Americans. In *Annual Report of the Bureau of American Ethnology to the Secretary of the Smithsonian Institution*. U.S. Government Printing Office, Washington, DC.

Hopkins, Nicholas A.
1999 The Native Languages of the Southeastern United States. Manuscript on file, Anthropology Program, Florida State University, Tallahassee.

Hornaday, W. T.
1889 The Extermination of the American Bison, with Sketch of Its Discovery and Life History. Report of the U.S. National Museum, Part 2, 367–548. U.S. Government Printing Office, Washington, DC.

Hosterman, John H.
1984 *Ball Clay and Bentonite Deposits of the Central and Western Gulf of Mexico Coastal Plain*. Bulletin 1558-C, U.S. Geological Survey.

Houck, Louis
1908 Map of Missouri Indian Trails and Warpaths. Plate following p. 226 in Louis Houck, *A History of Missouri from the Earliest Explorations and Settlements until the Admission of the State into the Union*. R. R. Donnelly, Chicago.

Houston Wilderness
2007 *Houston Atlas of Biodiversity*, Texas A&M University Press, College Station.

Howard, Martha A., Martha Doty Freeman, and C. Britt Bousman
1991 *Archeological Reconnaissance on Upper Greens Bayou, Harris County, Texas.* Reports of Investigations no. 83, Prewitt and Associates, Houston.

Hudgins, Joe D.
1981 Preliminary Report on the Wharton Site (41WH39). *Houston Archeological Society Newsletter*, no. 69:2–3.
1982 Historic [Period] Indian Site in Wharton County, Texas. *Houston Archeological Society Journal*74:2–8.
1985 Indian Component of Site 41WH16. *Houston Archeological Society Journal* 83:28–30.
1986 A Historic Indian Site in Wharton County, Texas. *Bulletin of the Texas Archeological Society* 55/1984: 29–51.
1993 Cooking with Clay Balls. *The Cache* (Texas Historical Commission), vol. 1:47–52.
1998 Marine Shell Found at Inland Aboriginal Occupation Sites in Wharton and Matagorda Counties, Texas. *Houston Archeological Society Journal* 120:1–10.
n.d. Shanklin Site. *Texas Beyond History*, www.texasbeyondhistory.net/coast/images/he3.html.

Hudgins, Joe D., and Sheldon Kindall
1984 Piekert Site. *Houston Archeological Society Journal* 80:9–22.

Hudler, Dale B.
1997 Determining Clear Fork Tool Function through Use-Wear Analysis: A discussion of Use-Wear Methods and Clear Fork Tools. Studies in Archeology 25, Texas Archeological Research Laboratory, Austin.

Huebner, Jeffrey A.
1988 A Clovis Point from 41GV101, Galveston County, Texas. *Houston Archeological Society Journal* 92:8–9.
1991 Late Prehistoric bison populations in Central and Southern Texas: *Plains Anthropologist* 6(137): 343–358.

Hunter, Robert Hancock
1860 The Narrative of Robert Hancock Hunter (manuscript), Texas State Archives, Austin, http://www.tamu.edu/faculty/ccbn/dewitt/hunternarrative.htm.

Imbrie, J., E. A. Boyle, S. C. Clemens, A. Duffy, W. R. Howard, G. Kukla, J. Kutzbach, D. G. Martinson, A. McIntyre, A. C. Mix, B. Molfino, J. J. Morley, L. C. Peterson, N. G. Pisias, W. L. Prell, M. E. Raymo, N. J. Shackleton, and J. R. Toggweiler
1992 On the Structure and Origin of Major Glaciation Cycles. 1: Linear Responses to Milankovich Forcing. *Paleoceanography* 7:701–738.

Jackson, Jack (editor)
2000 *Texas by Terán: The Diary Kept by General Manuel de Mier y Terán on his 1828 Inspection of Texas*. University of Texas Press, Austin.

Jelks, Edward B.
1962 The Kyle Site: A Stratified Central Texas Aspect Site in Hill Country, Texas. Archeology Series no. 5, Austin, Texas.
2017 The Archeology of Sam Rayburn Reservoir. HRC Research Reports, Vol. 3, Article 1. Available online at ScholarWorks, Stephen F. Austin University, Nacogdoches.

Jenkins, John T. Jr.
1978 Geology and Paleontology of the Upper Clastic Interval at Damon Mound. In *Damon Mound Field Trip Guidebook*, edited by Evelyn M. Etter, 45–61. Houston Geological Society.

Jenkins, Ned J., David H. Dye, and John A. Walthall
1986 Early Ceramic Development in the Coastal Plain. In *Early Woodland Archeology*, edited by Kenneth B. Farnsworth and Thomas E. Emerson, Center for American Archeology Press, Kampsville, Illinois 546–563.

Jennings, Jesse B.
1952 *Prehistory of the Lower Mississippi Valley*. In Archeology of Eastern United States, edited by James B. Griffin, 256–271. University of Chicago Press.

Jennings, Thomas A.
2008 *San Patrice Technology and Mobility across the Plains-Woodland Border*. Memoir 12, Oklahoma Anthropological Society.

Jeter, Marvin D., and Ann M. Early
1999 Prehistory of the Saline River Drainage Basin, Central to Southeast Arkansas. In *Arkansas Archaeology: Essays in Honor of Dan and Phyllis Morse*, edited by Robert C. Mainfort, Marvin D. Jeter, Dan F. Morse and Phyllis A. Morse, 31–64.

University of Arkansas Press, Fayatteville.

Jeter, Marvin D., and G. Ishmael Williams Jr.
1989 Ceramic-Using Cultures, 600 BC–AD 1000. In *Archeology and Bioarcheology of the Lower Mississippi Valley and Trans-Mississippi South in Arkansas and Louisiana*, edited by Marvin D. Jeter, Jerome C. Rose, G. Ishmael Williams Jr., and Anna M. Harmon, 111–170. Research Series no. 37, Arkansas Archeological Survey, Fayetteville.

Jodry, Margaret A., and Douglas W. Owsley
2014 A New Look at the Double Burial from Horn Shelter No. 2. In *Kennewick Man: The Scientific Investigation of an Ancient American Skeleton*, edited by Douglas W. Owsley and Richard L. Jantz, 549–603. Texas A&M University Press, College Station.

Johnson, Leroy Jr.
1983 Review of *Allens Creek: A Study in the Cultural Prehistory of the Lower Brazos Valley, Texas*, by Grant D. Hall. *Bulletin of the Texas Archeological Society* 502 (for 1982): 203–212.
1989 Great Plains Interlopers in the Eastern Woodlands during Late Paleo-Indian Times. Office of the State Archeologist Report 36, Texas Historical Commission.

Jones, Charles C.
1873 *Antiquities of the Southern Indians, Particularly of the Georgia Tribes*. D. Appleton and Company, New York.

Jones, Lawrence T. III
2014 *Lens on the Texas Frontier*. Texas A&M University Press, College Station. Also see Jones collection of photographic images, DeGolyear Library, Southern Methodist University, Dallas.

Jones, William K.
1969 Notes on the History and Material Culture of the Tonkawa Indians. *Smithsonian Contributions to Anthropology*, vol. 2, no. 5.

Kalm, Peter
1773 *Travels into North America*, vol. 2. T. Lowndes, London.

Kansas Historical Society
n.d. Scallorn Projectile Points. In *Kansas Memory* (online blog), Kansas Historical Society www.kansasmemory.org.

Kaspar, Timothy C.
1973 Fossil Vertebrates from the Late Pleistocene Taylor Bayou Local Fauna, Harris County, Texas. Unpublished Master's thesis, Midwestern University, Downers Grove, Illinois.

Kaspar, Timothy C., and William L. McClure
1976 The Taylor Bayou Local Fauna (Pleistocene) near Houston, Texas. *Southwestern Naturalist* (March 20, 1976), 21(1): 9–16.

Kaufman, David
2014 Another look at Atakapa. In *Kansas Working Papers on Linguistics* (University of Kansas), 35:72–78.

Keller, Christine K.
2009 Glacial Kame Sandal-Sole Shell Gorgets: An Exploration of Manufacture, Use, Distribution, and Public Exhibition. Unpublished Master's thesis, Ball State University, Muncie, Indiana.

Keller, Franz
1875 *The Amazon and Madeira Rivers: Sketches and Descriptions from the Note-book of an Explorer*. J.B. Lippincott & Co., Philadelphia.

Kelley, J. Charles
1986 Jumano and Patarabueve: Relations at La Junta de los Rios. Anthropological papers No. 77, Museum of Anthropology, University of Michigan, Ann Arbor.

Kemp, A.C., B. P. Horton, J. P. Donnelly, M. E. Mann, M. Vermeer, and S. Rahmstorf
2011 Climate Related Sea-Level Variations over the Past Two Millennia. *Proceedings of the National Academy of Sciences of the United States of America* 108:11017–11022.

Kenmotsu, Nancy A., and Douglas Boyd
2012 The Toyah Phase in Texas, an Introduction and Retrospective. In *The Toyah Phase of Central Texas: Late Prehistoric Economic and Social Processes*, edited by Nancy A. Kenmotsu and Douglas Boyd. Texas A&M University Press, College Station.

Kenmotsu, Nancy A., and John W. Arnn III
2012 The Toyah Phase and the Ethnohistorical Record. In Nancy A. Kenmotsu and Douglas Boyd, eds., The Toyah Phase of Central Texas: Late Prehistoric Economic and Social Processes. Texas A&M University Press 19-44.

Kibler, Karl W.
2012 The Role of Exotic Materials in Toyah Assemblages in a Late Prehistoric Economic and Social System. In *The Toyah Phase of Central Texas: Late Prehistoric Economic and Social Processes*, edited by Nancy A. Kenmotsu and Douglas Boyd, 76–90. Texas A&M University Press, College Station.

Kidder, T. R.
2001 Mapping Poverty Point. *American Antiquity* 67:89–101.

Kidder, T. R., E. R. Henry, and Lee J. Arco
2017 Rapid Climate Change-Induced Collapse of Hunter-Gatherer Societies in the Lower Mississippi River Valley between ca. 3300 and 2780 cal yr BP. Science China Earth Sciences, published online.

Kindall, Sheldon M.
1980 Peikert Site. *Houston Archeological Society Newsletter* 66:5–9.

Kniffen, Fred B., Hiram Gregory, and George Stokes
1987 *The Historic Tribes of Louisiana, from 1542 to the Present*. Louisiana State University Press, Baton Rouge.

Koch, Paul L., Noah S. Diffenbaugh, and Kathryn A. Hoppe
2004 The Effects of Late Quaternary Climate and pCO2 Change on C4 Plant Abundance in the South-Central United States. *Palaeogeography, Palaeoclimatology, Palaeoecology* 207(2004):331– 357.

Koch, Paul L., and Anthony D. Barnosky
2006 Late Quaternary Extinctions: State of the Debate. *Annual Review of Ecology, Evolution, and Systematics* 37:215–250.

Kolker, A.S., M. A. Allison, and S. Hameed
2011 An Evaluation of Subsidence Rates and Sea Level Variability in the

Northern Gulf of Mexico. *Geophysical Research Letters* 38, L21404.

Kornfeld, Marcel, George C. Frison, and Mary Lou Larson
2010 *Prehistoric Hunter-Gatherers of the High Plains and Rockies*. Left Coast Press, Walnut Creek, California.

Kraft, Kenneth Charles
1993 Corner-Tang Stone Artifacts of the Plains. Unpublished Master's thesis, Texas Tech University, Lubbock.

Krieger, Alex D.
1948 Importance of the "Gilmore Corridor" in culture contacts between Middle America and the Eastern United States. Bulletin of the Texas Archeological and Paleontological Society 19:155–178.

La Vere, David
2004 *The Texas Indians*. Texas A&M University Press, College Station.

Larsen, Brandon
n.d. Projectile points database, www.projectilepoints.net.

Laskow, Sarah
2017 Florida Has More Archeological Canoes than Anywhere Else in the World. Atlas Obscura, https://www.atlasobscura.com/articles/dugouts-florida-archaeology-canoes-native-americans.

Lauro, James, and Geoffrey R. Lehmann
1982 The Slate Site, a Poverty Point Lapidary Industry in the Southern Yazoo Basin, Mississippi. Archeological Report no. 7, Mississippi Department of Archives and History.

Lawson, John
1714 *The History of Carolina*. W. Taylor and F. Baker, London.

Lee, Aubra L.
2010 Troyville and the Baytown Period. In *Archeology of Louisiana*, edited by Mark Rees, 135–156. Louisiana State University Press, Baton Rouge.

Lefler, H. T.
1967 *A New Voyage to Carolina, by John Lawson* (reprint of 1709 edition). University of North Carolina Press, Chapel Hill.

Leidy, Joseph
1868 Notice of Some Remains of Extinct Pachyderms. *Proceedings of the Academy of Natural Sciences of Philadelphia* 20(1868):230–233. See also *Proceedings Acad. Nat. Sci Philadelphia* 22(1870):97.

Leith, Luther J.
2014 Towards a Common Understanding: A Revision of Fourche Maline Chronology in Oklahoma. *Index of Texas Archaeology*, Open Access Gray Literature from the Lone Star State, Vol. 2014, Article 22.

Lehman, Geoffrey R.
1982 The Jaketown Site: Surface Collections from a Poverty Point Regional Center in the Yazoo Basin, Mississippi: Mississippi Department of Archives and History, Jackson.

Lepper, Bradley T.
2006 Ancient DNA from the Ohio Hopewell. http://ohio-archaeology.blogspot.com, accessed June 22, 2006.

Levine, Steve D.
2002 Bones on the Bayou: Editor's Letter, Houston Geological Society, September 2002. Further documented by Jules Dubar, as reported by Jim Holliday. *Bulletin of the Houston Geological Society*, March 1962.

Lewis, C. R.
2009 An 18,000 Year Old Occupation along Petronila Creek in Texas. *Bulletin of the Texas Archeological Society* 80:15–50.

Lindsay, Rebecca
2019 Climate Change: Global Sea Level. *ClimateWatch Magazine* online (National Oceanographic and Atmospheric Administration), November 19, 2019.

Livsey, D., and A. R. Simms
2013 Holocene Sea-Level Change Derived from Microbial Mats. *Geology* 41:971–974.

Lohse, Jon C., Brendan Culleton, Stephen L. Black, and Douglas J. Kennett
2014 A Precise Chronology of Middle to Late Holocene Bison Exploitation in the Far Southern Great Plains. *Journal of Texas Archeology and History*, www.jtah.org.

Long, Russell J.
1977 *McFaddin Beach*. Patillo Higgins Series of Natural History and Anthropology no. 1, Spindletop Museum, Lamar University, Beaumont, Texas.

Lopinot, Nearl H., Jack H. Ray, and Michael D. Conner (editors)
1998 The 1997 Excavations at the Big Eddy Site (23CE426) in Southwest Missouri. Special Publication no.2, Center for Archeological Research, Southwest Missouri State University, Springfield.

Lundelius, E. L. Jr.
1972 *Fossil Invertebrates from the Late Pleistocene Ingleside Fauna, San Patricio County, Texas*. Report of Investigations 77, Bureau of Economic Geology, University of Texas, Austin.

Lynott, Mark
2015 *Hopewell Ceremonial Landscapes of Ohio: More than Mounds and Geometric Earthworks.* Oxbow Books, Oxford.

MacLaggan, Corrie
2013 What Ethnic Diversity Looks Like: Fort Bend: *New York Times*, Nov 23, 2013.

Madson, David B.
2015 A Framework for the Initial Occupation of the Americas. *PaleoAmerica* 1(3):217–250.

Madsen, D. B., and J. F. O'Connell (editors)
1982 *Man and Environment in the Great Basin*. Papers no. 2, Society for American Archaeology.

Mandelbaum, D. G.
1979 *The Plains Cree: An Ethnographic, Historical and Comparative Study*. Canadian Plains Research Center, Regina.

Mann, Charles C.
2002 1491. *Atlantic*, March 2002. www.theatlantic.com/magazine/archive/2002/03/1491/302445/.
2005 *1491: New Revelations of the World Before Columbus.* Knopf, New York.

McClure, W. L.
1976 White Oak Bayou, the Laura Lackner Site. *Houston Archeological Society Newsletter* 54:7–8.
1979a White Oak Bayou Continued. *Houston Archeological Society Newsletter* 63:14–16.
1979b White Oak Bayou 279, Continued. *Houston Archeological Society Newsletter* 64:10–13.
1979c White Oak Bayou 279, Continued. *Houston Archeological Society Newsletter* 65:9–13.
1980 White Oak Bayou Sites, Including 41HR279-A, Addendum. *Houston Archeological Society Newsletter* 67:14–25.
1986a The Laura Lackner Site Revisited. *Houston Archeological Society Journal* 84:5–12.
1986b Faunal Analysis of 41FB34. *Houston Archeological Society Journal*, 86:1–7.
1987a Faunal Analysis of 41FB37. *Houston Archeological Society Journal* 89:1–6.
1987b Bones from Site 41FB95. *Houston Archeological Society Journal* 89: 19–20.
1989 The Vertebrates of 41FB32. *Houston Archeological Society Journal* 93:15–21.
1991a Vertebrates of site 41WH20. *Houston Archeological Society Journal* 100:21–24.
1991b The Seeds and Vertebrates of Site 41WH50. *Houston Archeological Society Journal* 100:27–30.
1991c Vertebrates of Site 41WH20. *Houston Archeological Society Journal* 100: 21–24.
1993 The Vertebrates and Soils of 41FB35. *Houston Archeological Society Journal* 105:12–15.

McFadden, Paulette
2019 Prehistoric Canoes in Florida. Florida Department of State, Division of Historical Resources, Canoe Project, https://dos.myflorida.com/historical/archaeology/projects/canoes/.
n.d. What to do if you find a dugout canoe. Florida Archeology and Bioarcheology, Florid Museum, https://www.floridamuseum.ufl.edu/flarch/dugout-canoes/.

McGimsey, Charles R.
2010 Marksville and Middle Woodland. in *Archeology of Louisiana*, edited by Mark Rees, 120–134. Louisiana State University Press, Baton Rouge.

McIntire, William G.
1954 Prehistoric Settlements of Coastal Louisiana. Unpublished PhD dissertation, Department of Geography and Anthropology, Louisiana State University, Baton Rouge.

McNeill, J. R., and Peter Engelke
2014 *The Great Acceleration: An Environmental History of the Anthropocene since 1945*. Harvard University Press, Cambridge, Massachusetts.

McReynolds, Richard L.
1984 Two Tanged Knives from Val Verde County, Texas. *La Tierra* 11(2):6–11.

McReynolds, Mary Jane, Randy Korgel, and H. Blaine Ensor
1988 Archeological Investigations at a Late Ceramic Period Bison Kill Site (41HR541), Whiteoak Bayou, Harris County, Texas. Reports of Investigations 7, Archeological Research Laboratory, Texas A&M University, College Station.

Maddox, J., J. B. Anderson, K. Milliken, and A. B. Rodriguez
2008 The Holocene Evolution of the Matagorda and Lavaca Bay Estuary Complex, Texas, USA. In *Response of Gulf Coast Estuaries to Sea-Level Rise and Climate Change*, edited by J. B. Anderson and A. B. Rodriguez, 105–119. Special Paper 443, Geological Society of America.

Marcott, Shaun A., Jeremy D. Shakun, Peter U. Clark, and Alan C. Mix
2013 A Reconstruction of Regional and Global Temperature for the Past 11,300 Years. *Science* 339(6124):1198–1201.

Marquardt, William H., and Laura Kozuch
2016 The Lightning Whelk: An Enduring Icon of Southeastern North American Spirituality. *Journal of Anthropological Archaeology* 42:1–26.

Marr, John Columbus
1928 History of Matagorda County. Master's thesis, University of Texas, Austin.

Marshall, Bob
2016 Native Americans of Grand Bayou Seeking Help to Remain in Homeland. *The Lens Focused on New Orleans and the Gulf Coast*, December 27, 2016. https://thelensnola.org/2016/12/27/native-americans-of-grand-bayou-seeking-help-for-homeland/.

Martin, Paul S.
1967 Prehistoric Overkill. In *Pleistocene Extinctions: The Search for a Cause*, edited by Paul Martin and H. E. Wright Jr., 75–120. Yale University Press, New Haven.
2005 *Twilight of the Mammoths: Ice Age Extinctions and the Rewilding of America*. University of California Press, Berkely.

Mathewson, Christopher C., Robert L. Lytton, Cynthia L. Cason, Samuel W. Gowan, and Mark A. Brotherton
1985 *Exploration for Aggregates, Texas NE Gulf Coast*. Texas Transportation Institute, Study 2-9-79-267. Texas A&M University, College Station.

Mayewski, P. A., E. E. Rohling, J. C. Stager, W. Karlén, L. A. Laasch, L. D. Meeker, E. A. Meyerson, F. Gasse, S. van Kreveld, K. Holmgren, J. Lee-Thorp, G. Rosqvist, F. Rack, M. Staubwasser, R. R. Schneider, and E. J. Steig
2004 Holocene Climate Variability. *Quaternary Research* 62:243–255.

Meltzer, David J.
2006 *Folsom: New Archaeological Investigations of a Classic Paleoindian Bison Kill*. University of California Press, Berkeley.
2009 *First Peoples in a New World: Colonizing Ice Age America*. University of California Press, Berkeley.

Michigan State University
n.d. Michigan's Copper Deposits and Mining. Michigan State University Department of Geography, Environment and Spatial Sciences, http://geo.msu.edu/extra/geogmich/copper.html.

Milanich, Jerald T.
1994 *Archaeology of Precolumbian Florida*. University Press of Florida, Gainesville.

Milfort, Louis Leclerc.
1802 *Memoirs, or A Quick Glance at My Various Travels and My Sojourn in the Creek Nation*. www.homepages.rootsweb.com, accessed September 2019.

Milliken, K. T., J. B. Anderson, and A. B. Rodriguez
2008a A New Composite Holocene Sea-Level Curve for the Northern Gulf of Mexico. In *Response of Upper Gulf Coast Estuaries to Holocene Climate Change and Sea-level Rise*, edited by J. B. Anderson and A.B. Rodriguez, 1–11.L Special Paper 443, Geological Society of America.
2008b Tracking the Holocene Evolution of Sabine Lake through the Interplay of Eustasy, Antecedent Topography, and Sediment Supply Variations, Texas and Louisiana, USA. In *Response of Upper Gulf Coast Estuaries to Holocene Climate Change and Sea-Level Rise,* edted by J. B. Anderson and A. B. Rodriguez, 65–88. Special Paper 443, Geological Society of America.
2008c Record of Dramatic Holocene Environmental Changes Linked to Eustasy and Climate Change in Calcasieu Lake, Louisiana, USA. In *Response of Upper Gulf Coast Estuaries to Holocene Climate Change and Sea-Level Rise*, edited by J. B. Anderson and A. B. Rodriguez, 43–63. Special Paper 443, Geological Society of America.

Milner, G. R.
2004 *The Moundbuilders*. Thames and Hudson, New York

Mills, Lisa
2003 Mitochondrial DNA Analysis of the Ohio Hopewell of the Hopewell Mound Group. PhD dissertation, Department of Anthropology, Ohio State University, Columbus.

Mills, William C.
1916 Exploration of the Tremper Mound. *Ohio Archeological and Historical Quarterly* (Columbus) XXV (3): 262–398.
1922 Exploration of the Mound City Group. In *Certain Mounds and Villages of Ohio*, Vol. 3, part 4. A. W. McGraw, New York.

Mills, W. S.
1950 *The History of Van Zandt County*.

Irby Mills, Canton, Van Zandt County.
Mitchell, J. L., and C. D. Orchard
1984 Three Corner Tang Artifacts from the Olmos Dam Area, Bexar County, Texas. *La Tierra* 11(2):2–5.

Mithun, Marianne
1999 *The Languages of Native North America*. Cambridge University Press, Cambridge, U.K.

Mook, W. G., and H. T. Waterbolk
1985 *Radiocarbon Dating*. European Science Foundation, Strasbourg.

Moore, David
2011 Ecological Footprint Analysis, San Francisco-Oakland-Fremont California Metropolitan Statistical Area: Global Footprint Network, Oakland, CA.

Moore, Roger G.
1995 The Mossy Grove Model of Long-Term Forager-Collector Adaptations in Inland Southeast Texas. Unpublished PhD dissertation, Rice University, Houston.

Moore, William E.
1989 *An Archeological Survey of the Proposed Riverfront Park in the City of Beaumont (Jefferson County), Texas*. Contract Report no. 5, Brazos Valley Research Associates.
2015 An Index to the Houston Archeological Society Newsletters and Journals, 1959–2015. Contributions in Archeology no. 4, http://tinytexasjails.com/bvra/wp-content/uploads/2015/12/HAS-Index.pdf.

Moore, W. E. and J. Dockall
1988 Additional Artifacts from the Strawberry Hill Site (41SJ160) in San Jacinto County, Texas. *Houston Archeological Society Journal* 91:11–15.

Morfi, Juan Agustín
1779 *History of Texas, 1673–1779*. 2 vols. Quivira Society, Albuquerque, 1935; reprint, 1967, Arno, New York.

Morey, Darcy F., George Crothers, Julie Stein, James Fenton, and Nicholas Herrmann
2002 The Fluvial and Geomorphic Context of Indian Knoll, an Archaic Shell Midden in West-Central Kentucky. *Geoarcheology* 7(6):521–553.

Morse, D. F., and P. A. Morse
1983 *Archaeology of the Central Mississippi Valley*. Academic Press, New York.

Musgrove, MaryLynn, J. L. Banner, L. E. Mack, D. M. Combs, H. Cheng, and R. L. Edwards
2001 Geochronology of Late Pleistocene to Holocene Speleothems from Central Texas: Implications for Regional Paleoclimate. *GSA Bulletin* (December 2001) 113(12):1532–1543.

Myer, William E.
1928 Indian Trails of the Southeast. *Bureau of American Ethnology Report* no. 44, pp. 727–857.

Nassaney, Michael S., and Kendra Pyle
1999 The Adoption of the Bow and Arrow in Eastern North America: A View from Central Arkansas. *American Antiquity* 64(2):243–263.

Nature Conservancy
2019 Roy E. Larsen Sandyland Sanctuary: Saving the Big Thicket of Eastern Texas (fact sheet). https://www.nature.org/content/dam/tnc/nature/en/documents/gulf-coast-fact-sheet-3.pdf.

Neck, Raymond
1986 Analysis of Molluscan Remains Recovered from 41FB34, Fort Bend Co., Texas. *Houston Archeological Society Journal*, 86:8–10.

Neuman, Robert
1972 Archeological investigations at the Morton Shell Mound, Weeks Island, Iberia Parish, Louisiana. Report submitted to the National Science Foundation, Washington, D.C.

Newcomb, W. W. Jr.
1961 *The Indians of Texas, from Prehistoric to Modern Times*. University of Texas Press, Austin.

Nowlin, Jessica
2018 Twelve Thousand Years of Human History (in) Prehistoric Bexar County. In *300th Anniversary Celebration of Bexar: Historical GIS Story Map Projects*, Bexar County Information Technology (GIS) Team. https://maps.bexar.org/300/.

Oberste, W. H.
1942 *History of Refugio Mission*. Refugio Timely Remarks, Refugio, Texas.

O'Brien, Michael
1971 The Fullen Site, 41HR82. *Bulletin of the Texas Archeological Society* 42: 335–365.

Odezulu, C.I., H. Lorenzo-Truebam, D. J. Wallace, and J. B. Anderson
2018 Stratigraphic and Sedimentological Evidence for Unprecedented Shoreline Migration Rate during Historic Time: Follets Island, TX. In *Barrier Island Dynamics and Response to Changing Climate*, edted by L. J. Moore and A. B. Murray, 147–174. Springer, New York. https://doi.org/10.1007/978-3-319-68086-6-5.

Ohio History Central
2020 Hopewell Culture, Hopewell Mounds Group, Adena Culture: *Ohio History Central*, https://ohiohistorycentral.org. Accessed September 2020.

Otvos, E. G., and W. E. Howat
1996 South Texas Ingleside Barrier, Coastal Sediment Cycles and Vertebrate Fauna: Late Pleistocene Stratigraphy Revised. *Transactions of the Gulf Coast Association of Geological Societies* 46:333–344.

Owen, Donald E.
2008 Geology of the Chenier Plain of Cameron Parish, Louisiana. In *Geological Society of America Field Guide 14*, edited by G. Moore, 27–38. Joint Annual Meeting, Houston, Texas, October 5_9, 2008.

Paine, J. G.
1993 Subsidence of the Texas Coast: Inferences from Historical and Late Pleistocene Sea Levels. *Tectonophysics* 222:445–458.

Paine J. G., M. Sojan, and C. Tiffany
2012 Historical Shoreline Change through 2007, Texas Gulf Coast: Rates, Contributing Causes, and Holocene Context. *Gulf Coast Assoc. Geol. Soc. J.* 1:13–26.

Parker, A. A.
1835 *A Trip to the West and Texas, Comprising a Journey of Eight Thousand Miles*. William White Publishing, Concord, N.H.

Patterson, J. T.
1936 *The Corner-Tang Flint Objects of Texas*. Bureau of Research in the Social Sciences no. 18, Anthropological Papers, vol. 1, no. 4.
1937a Boat-Shaped Objects of the Gulf Southwest States. University of Texas, Bureau of Research in the Social Sciences no. 24, Anthropological Papers, vol. 1, no. 2.
1937b Supplementary Notes on the Corner-Tang Artifact. University of Texas Bulletin no. 3734, Anthropological Papers, vol. 1, no. 5.

Patterson, Leland W.
1975 Harris County, Texas Site 41HR182. *Houston Archeological Society Newsletter* 50:6–8.
1980 *The Owen Site, 41HR315: A Long Occupation Sequence in Harris Co., Texas*. Report no. 3, Houston Archeological Society.
1981 Fracture Force Changes from Heat Treating and Edge Grinding. *Flintknapper's Exchange* 4(3):6–9.
1985 A Long Occupation Sequence at Site 41HR182, Harris County, Texas. *Houston Archeological Society Journal* 81: 11–20.
1986 Site 41571: A Long Prehistoric Sequence in Harris County, Texas. *Houston Archeological Society Journal* 85:15–18.
1988 Archeological Sites in the Damon, Texas Area. *Houston Archeological Society Journal* 92:10–14.
1989a *A Data Base of Inland Southeast Texas Geology*. Report no. 6, Houston Archeological Society.
1989b *An Archeological Data Base for the Southeastern Texas Coastal Margin*. Report no. 7, Houston Archeological Society.
1989c Additional Comments on Fired Clayballs. *Houston Archeological Society Journal* 94:24–26.
1990a Characteristics of Bifacial Reduction Flake Size Distribution. *American Antiquity* 55(3):550–558.
1990b The Distribution of Coastal Margin Pottery Types in Southeast Texas. *Houston Archeological Society Journal* 97:14–19.
1990c Excavations at the J. D. Wells Site (41HR639), Harris County, Texas. *Houston Archeological Society Journal* 97:1–7.
1991 Mobility-Settlement Patterns and Population Dynamics of Inland Southeast Texas. *Houston Archeological Society Journal* 99:16–21.
1992a Prehistoric Bison Sites in Southeast Texas. *Houston Archeological Society Journal* 102:14–19.
1992b Current Data on the Use of the Bow and Arrow in Southern North America. *La Tierra* 19(4):6–15.
1993a An Introduction to Lithic Analysis. *Houston Archeological Society Journal* 105:16–25.
1993b The Boundary Between Inland and Coastal Margin Settlement Patterns in Southeast Texas. *Houston Archeological Society Journal* 93:14–18.
1995 Prehistoric Earth Ovens in Southeast Texas. *Houston Archeological Society Journal* 111:17–20.
1996 *Southeast Texas Archeology*. Report no. 12, Houston Archeological Society.
1997a *The Wheeless Archeological Collections*. Report no. 4, Fort Bend Archeological Society.
1997b *The Meitzen Archeological Collection, 41FB249*. Report no. 6, Fort Bend Archeological Society.
1998 Early Archaic Projectile Points in Southeast Texas: *Houston Archeological Society Journal* 121:1–13.
2000 Late Archaic Mortuary Tradition of Southeast Texas. *La Tierra* 27(2):28–44.
2004 Prehistoric Long-distance Trade in Eastern North America. *Ohio Archeologist* 54(3):32–33.
2005a *Bibliography of the Prehistory of the Upper Texas Coast*. Special Publication 13, Houston Archeological Society.
2005b Prehistoric Bifacial Knives in Southeast Texas. *Houston Archeological Society Journal* 129:22–26.
2006 *Cultural Sequence on the Coastal Margin of Southeast Texas*. Report no. 24, Houston Archeological Society.
2009 Characteristics of Shell Middens on the Coastal Margins of Southeast Texas. *Houston Archeological Society Journal* 132:5–10.

Patterson, Leland W., Elizabeth K. Aucoin, and Richard L. Gregg
2002 *Investigations of Site 41HR72, Harris County, Texas*. Report no. 19, Houston Archeological Society.

Patterson, Leland W., W. Marshall Black, William C. McClure, Rebecca Story, and Suzanne Patrick
1993a *Excavations at the Bowser Site, 41FB3, Fort Bend County, Texas*. Report no. 9, Houston Archeological Society.

Patterson, Leland W., S. D. Hemming, and W. L. McClure
1997 *Investigations at Site 41FB245, Fort Bend County, Texas*. Report no. 5, Forth Bend Archeological Society.

Patterson, Leland W., and J. D. Hudgins
1980 Preceramic Sites 41HR2 and 41HR7, Wharton County, Texas. *Houston Archeological Society Newsletter* 66:34–39.
1982 A Multi-Component Prehistoric Site, 41WH65, Wharton County, Texas. *Houston Archeological Society Journal* 74:11–16.
1985 Paleo-Indian Occupations in Wharton County, Texas. *Bulletin of the Texas Archeological Society* 56:155–170.
1986 Test Excavations at Site 41FB34, Fort Bend Co., Texas. *Houston Archeological Society Journal* 85:1–7.
1987a Test Excavations at Site 41FB37, Fort Bend Co., Texas. *Houston Archeological Society Journal* 88:1–8.
1987b The Konvicka Collection (41FB95), Fort Bend Co., Texas. *Houston Archeological Society Journal* 89:1–18.
1987c The Barnhill Collection, 41WH18, Wharton County Texas. *Houston Archeological Society Journal* 87:23–28.
1988 Prehistoric Sites 41WH50-51, Wharton Co., Texas. *Houston Archeological Society Journal* 91:1–10.
1989a Excavations at Site 41WH12, Wharton County, Texas. *Houston Archeological Society Journal* 95: 1–11.
1989b Indian Component of Site 41WH40, Wharton County, Texas. *Houston Archeological Society Journal* 95:18–22.
1989c A Late Prehistoric Site (41FB43), Fort Bend County, Texas. *Houston Archeological Society Journal* 93: 25–26.
1991 The George S. Rhemann Collection, 41F8198, Fort Bend Co., Texas. *Houston Archeological Society Journal* 99:25–29
1992 Excavations at Site 41WH73, Wharton Co., Texas. *Houston Archeological Society Journal* 104:1–10.

Patterson, Leland W., Joe D. Hudgins, and Richard L. Gregg
2006 Additional Excavations at 41FB28, Fort Bend County, Texas. *Houston Archeological Society Journal* 130:1–11.

Patterson, Leland W., J. D. Hudgins, R. L. Gregg, Sheldon M. Kindall, W. L. McClure, and Raymond W. Neck
1993b Excavations at the Ferguson Site, Fort Bend County, Texas. Report no. 10, Houston Archeological Society.

Patterson, Leland W., J. D. Hudgins, R. L. Gregg, W. L. McClure
1987 *Excavations at Site 41WH19, Wharton County, Texas*. Report no. 4, Houston Archeological Society.

Patterson, Leland W., J. D. Hudgins, Sheldon M. Kindall, R. L. Gregg, W. L. McClure
1996 Excavations at the Kojolaco Site, 41WH21, Wharton County, Texas. *Houston Archeological Society Journal* 116:1–16.

Patterson, Leland W., Joe D. Hudgins, Sheldon M. Kindall, William L. McClure, Marianne Marek, Tom Nuckols, Richard L. Gregg
1999 *Additional Excavations at the Bowser Site, 41FB3, Fort Bend County, Texas, Part 1: Archeology*. Report no. 14, Houston Archeological Society.

Patterson, Leland W., Joe D. Hudgins, and W. L. McClure
2000a *Excavations at Site 41FB28, Fort Bend County, Texas*. Report no. 17, Houston Archeological Society.

Patterson, Leland W., Joe D. Hudgins, W. L. McClure, Sheldon M. Kindall, and Richard L. Gregg
1994 Excavations at the Joe Davis Site, 41FB223, Fort Bend County, Texas. Report no. 11, Houston Archeological Society.

Patterson, Leland W., Joe D. Hudgins, E. Palmer, and T. Palmer
2000b Excavations at the Crutcher Site, 41FB282, Fort Bend Co., Texas. *Houston Archeological Society Journal* 126:1–10.
2003 Excavations at the Goloby Site, 41WL3, Waller County, Texas. Report no. 22, Houston Archeological Society.
2005 Excavations at the Hornbuckle Site, 41WL27, Waller County, Texas. *Houston Archeological Society Journal* 129: 1–13.

Patterson, Leland W., Sheldon Kindall, William McClure, and Elizabeth K. Aucoin
2001 *Additional Investigations at 41GV53, Galveston County, Texas*. Report no. 18, Houston Archeological Society.

Patterson, Leland W., J. D. Lockwood, R. L. Gregg, and S. M. Kindall
1992a The Lockwood Collection (41HR343), Harris County, Texas. *Houston Archeological Society Journal* 104:16–24.
1992b Prehistoric Sites 41HR354, 730, 731,732, Harris County, Texas. *Houston Archeological Society Journal* 104:17–30.

Pearce, John E.
1932 The Archeology of East Texas. *American Anthropologist* 34(4):670–687

Pearson, C. E., R. A. Weinstein, and D. B. Kelley
1989 Evaluation of Prehistoric Site Preservation on the Outer Continental Shelf: the Sabine River Area, Offshore Texas and Louisiana. In *Underwater Archaeology Proceedings from the Society for Historical Archaeology Conference*, 6–11. Baltimore, Maryland.

Pedersen, Mikkel W., Anthony Ruter, Charles Schweger, and others
2016 Postglacial Viability and Colonization in North America's Ice-Free Corridor. *Nature* 537:45–49.

Peregrine, Peter G., and Melvin Ember
2002 *Encyclopedia of Prehistory*, Vol. 9: *Cumulative Index*. Human Relations Area Files, Yale University. Kluwer Academic–Plenum Publishers, New York.

Perkins, William R.
n.d. Atlatl Weights, Function and Fashion. Society of Primitive Technology, www.hollowtop.com.

Perttula, Timothy K.
1992 *The Caddo Nation: Archaeological and Ethnohistoric Perspectives*: University of Texas Press, Austin.
1999 *The Hurricane Hill Site (41HP106), The Archaeology of a Late Archaic/Early Ceramic and Early-Middle Caddoan Settlement in Northeast Texas, Vol. I*. Index of Texas Archaeology, Open Access Gray Literature from the Lone Star State: Vol. 1999, Article 23.
2001 Prehistoric Ceramic Sherds from 41MM341 on the Little River, Milam County, Texas. *Index of Texas Archaeology*, Open Access Gray

Literature from the Lone Star State, Vol. 2001, Article 28.
2004 Prehistoric and Caddoan Archeology of the Pineywoods. In *The Prehistory of Texas*, edited by Timothy K. Perttula. Texas A&M University Press, College Station.
2012 Trends in Archaic and Woodland Period Use of the Middle Sabine River Basin Based on Dart Point Proportions. *Index of Texas Archaeology*, Open Access Gray Literature from the Lone Star State, Vol. 2012, Article 24.
2013 Paleoindian to Middle Archaic Projectile Points from East Texas: *Journal of Northeast Texas Archaeology* 42:33–46.
2016 The Archeology of the Archaic Periods in East Texas. *Journal of Northeast Texas Archeology* 16:61–89.
2018 Analysis of Aboriginal Ceramic and Lithic Artifacts from Sites on National Forest Lands in East Texas. *Journal of Northeast Texas Archaeology* 77:1–122.
2020 Caddo Indians. *Handbook of Texas Online*, www.tsahonline.org/handbook/online/articles/bmcaj, accessed June 10, 2020.

Pertulla, Timothy K., and Linda W. Ellis
2013 Aboriginal Ceramics Among Groups Living in the Prairie Savanna Region of Texas. *Bulletin of the Texas Archeological Society* 84:113–135.

Perttula, Timothy K., Myles R. Miller, Robert A. Ricklis, Daniel J. Prikryl, and Christopher Lintz
1995 Prehistoric and Historic Aboriginal Ceramics in Texas. *Bulletin of the Texas Archeological Society* 66:175–234.

Perttula, Timothy K., Bo Nelson, Mark Walters, and Robert Cast
2013 Documentation of Caddo Funerary Objects from the Crenshaw Site (3MI6) in the Gilcrease Museum Collections. Archived at CRHR: Archaeology, Center for Regional Heritage Research, Stephen F. Austin University, Nacogdoches, Texas.

Perttula, Timothy K. and Dee Ann Story
n.d. Caddo Ancestors: Texas Beyond History online site, Texas Archeological Research Laboratory, Austin. www.texasbeyondhistory.net.

Perttula, Timothy K., and Mark Walters
2016 The Jonas Short Site (41SA101), San Augustine County, Texas. *Journal of Northeast Texas Archaeology* 62:19–30.

Petit, J. R., J. Jouzel, D. Raynaud, N. I. Barkov, J.-M. Barnola, I. Basile, M. Bender, J. Chappellaz, M. Davis, G. Delaygue, M. Delmotte, V. M. Kotlyakov, M. Legrand, V. Y. Lipenkov, C. Lorius, L. Pepin, C. Ritz, E. Saltzman, and M. Stievenard
1999 Climate and Atmospheric History of the Past 420,000 Years from the Vostok Ice Core, Antarctica,. *Nature* 399:429–436)

Phillips, P., and J. A. Brown
1978 *Pre-Columbian Shell Engravings from the Craig Mound at Spiro, Oklahoma,* part 1, vol. 1. Peabody Museum of Archeology and Ethnology, Harvard University.

Pinkerton, Gary L.
2017 An 1821 Trip Down Trammel's Trace. *East Texas Historical Journal* 55(2), Article 4.

Pirmez, Carlos, B. E. Prather, G. Mallarino, W. W. O'Hayer, A. W. Droxler, and C. D. Winker
2012 Chronostratigraphy of the Brazos-Trinity Depositional System, Western Gulf of Mexico: Implications for Deepwater Depositional Models. In *Application of the Principles of Seismic Geomorphology to Continental-Slope and Base-of-Slope Systems: Case Studies from Seafloor and Near-Seafloor Analogues,* 111–143. Society of Economic Paleontologists and Mineralogists Special Publication no. 99.

Politis, Gustavo, María Gutiérrez, and Lara Scabuzzo (editors)
2014 Estado actual de las investigaciones en el sitio Arroyo Seco 2. Universidad del Centro de la Provincia de Buenos Aires, Argentina

Post, Lauren C.
1962 Some Notes on the Attakapas Indians of Louisiana. *Journal of the Louisiana Historical Association* 3(3):221–242.

Prewitt, Elton R.
1981a Cultural Chronology in Central Texas. *Bulletin of the Texas Archeological Society* 52:65–89.
1981b *Archeological Investigations at the Loeve-Fox, Loeve, and Tombstone Bluff sites in the Granger Lake District of Central Texas*. Texas Archeological Survey, University of Texas at Austin.
1983 From Circleville to Toyah: Comments on Central Texas Chronology. *Bulletin of the Texas Archeological Society* 54:201–238.
1995 Distributions of Typed Projectile Points in Texas. *Bulletin of the Texas Archeological Society* 66:83–175.
2014 A Quick (and Rough) Temporal Guide to Texas Projectile Points (unpublished data shared with the author).
2017 Central and Southwest Texas Chronology: A Rough Guide to Projectile Point Index Markers (unpublished data shared with the author).

Purdy, B. A., and H. K. Brooks
1971 Thermal Alteration of Silica Minerals: An Archeological Approach. *Science* 173:322–325.

Quigg, J. Michael
2019 Petronila Creek: Another Attempt at Dating. *Gault School of Archeological Research Newsletter*, Winter 2019, 6–9.

Quigg, J. Michael, Chris Lintz, Grant Smith, and Scott Wilcox
2000 The Lino Site: A Stratified Late Archaic Campsite in a Terrace of the San Idelfonz Creek, Webb County, Southern Texas. *Index of Texas Archaeology*, Open Access Gray Literature from the Lone Star State, Vol. 2000, Article 11.

Rahmstorf, S., A. Cazenave, J. A. Church, J. E. Hansen, R. F. Keeling, D. E. Parker, and R. C. J. Somerville
2007 Recent Climate Observations Compared to Projections. *Science* 316: 709.

Ray, Jack H.
2017 *Ear Spools, Ceramics, and Burial Mounds from Southwest Missouri: Caddoan and Spiro Connections on the Northern Frontier*. Southeastern Archeology, vol. 37.

Rees, Mark A. (editor)
2010a *Archeology of Louisiana*. Louisiana State University Press, Baton Rouge.
2010b Plaquemine and Mississippian. In *Archeology of Louisiana*, edited by

Mark Rees, 172–194. Louisiana State University Press, Baton Rouge.

Rees, William, and Mathis Wackernagel
1994 Urban Ecological Footprints: Why Cities Cannot be Sustainable—And Why They Are a Key to Sustainability. *Environmental Impact Assessment Review* 16:223-248. Elsevier Sciences Inc., New York.

Redder, A. J.
1985 Horn Shelter Number 2: The South End, A Preliminary Report: *Central Texas Archaeologist* 10:37–65.

Reimer, Paula J., Edouard Bard, Alex Bayliss, and J. Warren Beck
2013 IntCal13 and Marine13 Radiocarbon Age Calibration Curves 0–50,000 Years Cal BP. *Radiocarbon* 55:1869–1887.

Renick, B. C.
1936 *The Jackson Group and the Catahoula and Oakville Formations in a Part of the Texas Gulf Coastal Plain*. University of Texas Bulletin, no. 3619.

Reynolds, John D
1986 Notes on File at the Kansas State Historical Society, 14 CF 343, TWH#100.

Rhodes, Edward J.
2011 Optically Stimulated Luminescence Dating of Sediments over the Past 200,000 Years. *Annual Review of Earth and Planetary Sciences* 39:461–488.

Ricklis, Robert A.
1994 *Aboriginal Life and Culture on the Upper Texas Coast: Archaeology at the Mitchell Ridge Site, 41GV66, Galveston Island*. Coastal Archaeological Research, Corpus Christi.
1995 The Ceramics of the Toyah Horizon and the Rockport Phase as Indicators of Some Basic Sociocultural Patterns. In *Prehistoric and Historic Aboriginal Ceramics in Texas*, by Timothy K. Perttula, Myles R. Miller, Robert A. Ricklis, Daniel J. Prikryl, and Christopher Lintz, 195–203. Bulletin of the Texas Archeological Society, vol. 66.
1996 *The Karankawa Indians of Texas: An Ecological Study of Cultural Tradition and Change*. University of Texas Press, Austin.
2004 The Archeology of the Native American Occupation of Southeast Texas; and Prehistoric Occupation of the Central and Lower Texas Coast. In *The Prehistory of Texas*, edited by Timothy K. Perttula, 155–204. Texas A&M University Press, College Station.
2010 Data Recovery at the McGloin Bluff Site (41SP11): A Late Prehistoric Rockport Phase Fishing Camp on Corpus Christi Bay. *Current Archeology in Texas*12(2):8–15 (Texas Historical Commission, November 2010, see figure 9).
2013 The Rockport Ware Pottery of the Central Texas Coast: Form, Technology, Style, and Ethnic Affiliation. *Bulletin of the Texas Archeological Society*84:87–114.
n.d. The Prehistory of the Texas Coastal Zone: 10,000 Years of Changing Environment and Culture: Texas Beyond History. Texas Historical Commission, Austin. https://texasbeyondhistory.net/coast/prehistory/images/intro.html, accessed 2020.

Ricklis, Robert A., and Steve Black
2019 Mitchell Ridge. *Texas Beyond History*, Texas Historical Commission, https://texasbeyondhistory.net/mitchell/ethnohistory, accessed 2019.

Ricklis, Robert A., and Michael B. Collins
1994 Archaic and Late Prehistoric Human Ecology in the Middle Onion Creek Valley, Hays County, Texas. Studies in Archeology 19, Texas Archeological Research Laboratory, University of Texas, Austin.

Rifkin, Riaan F.
2011 Assessing the Efficacy of Red Ochre as a Prehistoric Hide Tanning Ingredient. *Journal of African Archaeology*9(2):131–158.

Rifkin, R. F., L. Dayet, A. Queffelec, F. d'Errico, B. Summers, and M. Lategan
2015 Evaluating the Photoprotective Effects of Red Ochre on Human Skin by in Vivo SPF Assessment: Implications for Human Evolution, Adaptation and Dispersal. PLOS ONE doi:10.1371/journal.pone.0136090.

Ring, E. Raymond Jr.
1994 The Galena Sites (41HR61-41HR70): A Late Archaic to Late Prehistoric Complex in Harris County, Texas. *Bulletin of the Texas Archeological Society* 65:257–300.

Rignot, E., I. Velicogna, M. R. van den Broeke, A. Monaghan, and J. T. M. Lenaerts
2011 Acceleration of the Contribution of the Greenland and Antarctic Ice Sheets to Sea Level Rise. *Geophysical Research Letters* 38, L05503. http://dx.doi.org/10.1029/2011GL046583.

Ring, E. R. Jr.
1994 The Galena Sites (41HR61-41HR70): A Late Archaic to Late Prehistoric Complex in Harris County, Texas. *Bulletin of the Texas Archeological Society* 65:257–300.

Robison, Jade L.
2018 The Multi-Vocal Trailscape of the Natchitoches Trace: A Trail of Tears, Trade and Transformation. *Landscapes: The Journal of the International Centre for Landscape and Language* 8(1):1–31 (online).

Robinson, Chance
2012 Spatial Trends and Factors of Pimple Mound Formation in East-Central Texas. Unpublished PhD dissertation, Texas A&M University, College Station.

Rodriguez, A. B., J. B. Anderson, F. P. Siringan, and M. Taviani
1999 Sedimentary Facies and Genesis of Holocene Sand Banks on the East Texas Inner Continental Shelf. In *Isolated Shallow Marine Sand Bodies*, edited by J. W. Snedden and K. M. Bergman, 165–178. Society for Sedimentary Research Special Publication 64.
2004 Holocene Evolution of the East Texas Coast and Inner Continental Shelf: Along-Strike Variability in Coastal Retreat Rates. *J. Sediment. Res.* 74:405–421.

Rodriguez, A. B., M. Fassell, M., and J. B. Anderson
2001 Variations in Shoreface Progradation and Ravinement along the Texas Coast, Gulf of Mexico. *Sedimentology* 48:837–853.

Rodrigues, K., W. J. Rink, M. B. Collins, T. J. Williams, A. Keen-Zebert, and G. I. López
2016 OSL Ages of the Clovis, Late Paleoindian, and Archaic Components at Area 15 of the Gault

Site, Central Texas, U.S.A. *Journal of Archeological Science*, Reports,7:94–103.

Roe, E. G.
1970 *The North American Buffalo: A Critical Study of the Species in its Wild State*. University of Toronto Press, 2nd ed.

Roe, Herb
2008 Map of Hopewell Interaction Sphere, North America. Online at Wikimedia Commons.

Roe, Lori M., and Timothy M. Schilling
2010 Coles Creek. In *Archeology of Louisiana*, edited by Mark Rees, 157–171. Louisiana State University Press, Baton Rouge.

Roemer, Ferdinand
1849 *Texas, Mit besonderer Rücksicht auf deutsche Auswanderung imd die physischen Verhältnisse des Landes nach eigener Beobachtung geschildert.* Adolph Marcus, Bonn, Germany; translated by Oswald Mueller, Standard Printing Company, San Antonio, 1935; republished as *Roemer's Texas,* Eakin, Austin 1995; Mockingbird Books, Tracy, California, 2012.

Rogers, R.
1991 *National Register Testing of Nine Prehistoric Sites at the Gibbons Creek Five-Year Mine Area, Grimes Co., Texas*. Espey, Huston and Associates.
1993 *Data Recovery of Three Prehistoric Sites at the Gibbons Creek Third Five-Year Mine Permit Area, Grimes Co., Texas*. Espey, Huston and Associates
1994a Data Recovery at Three Sites at Gibbons Creek Mine (Grimes Co.). *CRM News and Views* (THC), 6(2):11.
1994b *Excavations at Site 41GM224 in the Gibbons Creek Lignite Mine Permit 38A Area, Grimes Co., Texas*. Espey, Huston and Associates.
1994c Site 41GN224 at Gibbons Creek Lignite Mine. *CRM News and Views* (THC), 6(1):10–11.
1995 *Excavations at Sites 41GM166, 41GM281, and 41GM282 at the Gibbons Creek Lignite Mine, Grimes County, Texas*. Espey, Huston and Associates.

Roos, Christopher I., María Nieves Zedeñob, Kacy L. Hollenback, and Mary M. H. Erlick
2018 Indigenous Impacts on North American Great Plains Fire Regimes of the Past Millennium: *Proceedings of the National Academy of Sciences* 115(32):8143–8148.

Rowe, Simone B.
2014 Wister Area Fourche Maline: A Contested Landscape. Unpublished PhD dissertation, University of Oklahoma, Norman.

Russell, Jeffrey D.
1975 Identification of Pleistocene Fossils from McFaddin Beach, Texas. Unpublished MS thesis, Lamar University, Beaumont, Texas.

Russo, Michael, and Gregory Heide
2004 The Emergence of Pottery in South Florida. In *Early Pottery: Technology, Function, Style, and Interaction in the Lower Southeast*, edited by Rebecca Saunders and Christopher T. Hays, 105–128. University of Alabama Press, Tuscaloosa.

Sabot, Thierry
2000 Les poids et mesures sous l'Ancien Régime [The weights and measures of the Ancient Régime] (in French, online). Also see Wikipedia, Units in France before the French Revolution, retrieved November 2019.

Saner, Bryant Jr., and Steve A. Tomka
1998 Unifacial Corner-Tang Artifact Report: An Investigation of an Unusual and Rarely Reported Lithic Tool. *La Tierra* 25(3): 24–36.

Saunders, J., and T. Allen
1997 The Archaic Period. *Louisiana Archaeology* 22:1–30.

Saunders, Joe W.
2010 Middle Archaic and Watson Brake. In *Archeology of Louisiana*, edited by Mark Rees, 63–76. Louisiana State University Press, Baton Rouge.

Saunders, Rebecca, and Christopher T. Hays
2004 Introduction: Themes in Early Pottery Research. In *Early Pottery: Technology, Function, Style, and Interaction in the Lower Southeast*, edited by Rebecca Saunders and Christopher T. Hays, 1–22. University of Alabama Press, Tuscaloosa.

Schambach, Frank F.
1982 An Outline of Fourche Maline Culture in Southwest Arkansas. In *Arkansas Archeology in Review*, edited by N. L. Turbowitz and M. D. Jeter, 76–197. Arkansas Archeological Survey, Fayetteville.
1997 The Development of the Burial Mound Tradition in the Caddo Area. *Journal of Northeast Texas Archeological Society*, no. 9. Online in *Index of Texas Archaeology*, Open Access Gray Literature from the Lone Star State, Vol. 1997, Article 40.
1998 *Pre-Caddoan Cultures in the Trans-Mississippi South: A Beginning Sequence*. Research Series 53, Arkansas Archeological Survey, Fayetteville.
2002 Fourche Maline: A Woodland Period Culture of the Trans-Mississippi South. In *The Woodland Southeast*, edited by R. C. Mainfort Jr. and D. G. Anderson, 90–112. University of Alabama Press, Tuscaloosa.
2008 Gulf Coast Shell and the Poverty Point Interaction Sphere. In *The William G" (Bill) Haag Honorary Symposium*, March 7–9, Louisiana State University, Baton Rouge. Occasional Paper 26, University of Memphis Anthropological Research Center.

Schambach, Frank F., and Ann M. Early
1994 Southwest Arkansas. In *A State Plan for the Conservation of Archeological Resources in Arkansas*, edited by Hester A. Davis, pp. SW1–SW149. Research Series no. 21, Arkansas Archeological Survey, Fayetteville.

Sears, Williams H.
1962 Hopewellian Affiliations of Certain Sites on the Gulf Coast of Florida. *American Antiquity* 28(1):5–18.

Seton, Ernest T.
1910 *Life Histories of the Northern Animals: An Account of the Mammals of Manitoba*: London, Constable and Company.

Shackleton, N.J.
1987 Oxygen isotopes, ice volume and sea level. *Quaternary Science Reviews* 6:183–190.

Shafer, H. J.
1966 *An Archeological Survey of Wallisville Reservoir, Chambers County, Texas*.

Report no. 2, Texas Archeological Salvage Project.
1973 Lithic technology at the George C. Davis site, Cherokee County, Texas.Ph.D. dissertation, Department of Anthropology, University of Texas at Austin.
2006 People of the Prairie: A Possible Connection to the Davis Site Caddo. Texas Department of Transportation and Prewitt and Associates.
2011 Lithic Technology at the George C. Davis Site, Cherokee County, Texas. Center for Regional Heritage Research, Archaeology no. 79, Stephen F. Austin University. https://scholarworks.sfasu.edu/crhr/79.

Shakun, Jeremy D., Peter U. Clark, Feng He, Shaun A. Marcott, Alan C. Mix, Zhengyu Liu, Bette Otto-Bliesner, Andreas Schmittner, and Edouard Bard
2012 Global Warming Preceded by Increasing Carbon Dioxide Concentrations during the Last Deglaciation. *Nature* 484:49–55.

Shetler, S.
1991 Three Faces of Eden. In *Seeds of Change: A Quincentennial Commemoration*, edited by H. J. Viola and C. Margolis, 225–247eds. Smithsonian Institution Press, Washington, DC.

Sievert, April K.
2011 Artifacts from the Craig Mound at Spiro, Oklahoma. Smithsonian Contributions to Anthropology 49. Smithsonian Institution Scholarly Press, Washington, D.C.

Simms A. B., J. B. Anderson, and M. Blum
2006 Mustang Island, an Example of an Aggradational Barrier Island. *Sedimentary Geology* 187:105–125.

Simms, A. R., J. B. Anderson, K. T. Milliken, Z. P. Taha, and J. S. Wellner
2007 Geomorphology and Age of the Oxygen Isotope Stage 2 (Last Lowstand) Sequence Boundary on the Northwestern Gulf of Mexico Continental Shelf. In *Seismic Geomorphology: Applications to Hydrocarbon Exploration and Production*, edited by R. J. Davies, H. W. Posamentier, L. J. Wood, and J. A. Cartwright, 29–46. Special Publication 277, Geological Society, London.

Simms, Alexander R., John B. Anderson, Regina DeWitt, Kurt Lambeck , and Anthony Purcell
2013a Quantifying Rates of Coastal Subsidence since the Last Interglacial and the Role of Sediment Loading. *Global and Planetary Change* 111:296–308.
2013b Calculating Rates of Coastal Subsidence from the Last Interglacial (LIG) Shorelines: A Late Pleistocene Gulf of Mexico Perspective Illustrating the Importance of Sediment Loading. *Global and Planetary Change* 111C:296–308, doi: 10.1016/j.gloplacha.2013.10.002.

Singleton, Hugh D.
1996 *The Dummyline, a Neighborhood Unique – Atakapa Indians and others*: published by the author in Hammond, Louisiana; copy accessed at the State Library of Louisiana, Baton Rouge.

Singleton, Scott W.
2008 Petrified Wood in the Miocene Fleming Formation, Jasper County, Texas. *Gulf Coast Association of Geological Societies Transactions* 58:797–813.

Sjoberg, Andree F.
1951 The Bidai Indians of Southeastern Texas. *Southwestern Journal of Anthropology* 7(4):391–400.

Skinner, Alanson
1912 Traces of the Stone Age among the Eastern and Northern Tribes. *American Anthropologist*, New Series 14(2):391–395.

Slaughter, Bob H.
1966 The Moore Pit Local Fauna: Pleistocene of Texas. *Journal of Paleontology* 40:78–91.

Slaughter, Bob H., and William L. McClure
1965 The Sims Bayou Local Fauna: Pleistocene of Houston, Texas. *Texas Jour. Sci*. 17:404–17.

Smith, F. Todd
1995 *The Caddo Indians*. Texas A&M University Press, College Station.
2005 *From Dominance to Disappearance: The Indians of Texas and the Near Southwest, 1786–1859*. University of Nebraska Press, Lincoln.

Smith, Harlan I.
1910 The Prehistoric Ethnology of a Kentucky Site. *Anthropological Papers of the American Museum of Natural History*VI:173–236.

Smith, John
1624 *The Generall Historie of Virginia, New England & the Summer Isles: Together with the True Travels, Adventures and Observations, and a Sea Grammar*, vol. 1. Reprint, 1907, J. MacLehose Publishers, Bermuda.

Smith, Ralph A.
1959 Account of the Journey of Bénard de la Harpe, Discovery Made by Him of Several Nations Situated in the West (translation from the original). *Southwestern Historical Quarterly* LXII:525–541.

Smithsonian Institution
2019a Collections Notes on Atakapa Items, http://collections.si.edu/search/results.htm?q=Atakapa&start=20.
2019b Infinity of Nations Collection, https://americanindian.si.edu/exhibitions/infinityofnations/woodlands.html.

Smothers, W. J., N. F. Williams, and H. J. Reynolds
1952 *Ceramic Evaluation of Arkansas Nepheline Syenite*. Division of Geology Information Circular 16. Arkansas Resources and Development Commission, Fayetteville..

Solecki, Ralph S.
1953 Exploration of an Adena Mound at Natrium, West Virginia. *Anthropological Papers*, Bureau of American Ethnology, Washington, DC. Bulletin 151, no. 40, pp. 313–95.

Solis, Raul F.
1981 *Upper Tertiary and Quaternary Systems, Central Coastal Plain, Texas*. Report of Investigations no. 108, Bureau of Economic Geology, University of Texas, Austin.

Speck, Frank G.
1911 *Ceremonial Songs of the Creek and Yuchi Indians*, with music transcribed by Jacob D. Sapir. Anthropological Publications, vol. 1, no. 2. University of Pennsylvania Museum.

1938 The Cane Blowgun in Catawba and Southeastern Ethnology. *American Anthropologist* 40 (April–June 1938):198–204.

Speth, John D.
2017 13,000 Years of Communal Bison Hunting in Western North America. In *The Oxford Handbook of Zooarcheology*, edited by Umberto Albarella, Mauro Rizzetto, Hannah Russ, Kim Vickers, and Sarah Viner-Daniels. Oxford Handbooks Online.

Spratt, R. M., and L. E. Lisiecki.
2016 A Late Pleistocene Sea Level Stack. *Climate of the Past* 12:1079–1092.

Squier, E. G., and E. H. Davis
1848 *Ancient Monuments of the Mississippi Valley*. Smithsonian Institution, Washington, DC.

Stanford, Dennis J.
1978 The Jones-Miller Site: An Example of Hell Gap Bison Procurement Strategy. In *Bison Procurement and Utilization*, edited by Leslie B. Davis and Michael C. Wilson. *Plains Anthropologist Memoir* 14, vol. 23(82):90–97.

Stewart, Omer C.
2002 *Forgotten Fires: Native Americans and the Transient Wilderness*: University of Oklahoma Press, Norman..

Story, Dee Ann
1990 Cultural History of the Native Americans. In *The Archeology and Bioarcheology of the Gulf Coast Plain*, vol. 2. Research Series no. 38, 163–366. Arkansas Archeological Survey, Fayetteville.

Story, Dee Ann, and Harry L. Shafer
1966 *1964 Excavations at Waco Reservoir, McLennan County, Texas: The Raylor and Britton Sites*. Miscellaneous Papers no. 6, Texas Archeological Salvage Project, Austin.

Stoutamire, Steve, and Mike McBride
2020 A Rock's Long Journey: Unraveling Bedrock Sources to Deposition Areas for the Uvalde Gravels: Bulletin of the Texas Archeological Society 91:187–203.

Stright, Melanie J., Eileen M. Lear, and James F. Bennett
1999 *Spatial Data Analysis of Artifacts Redeposited by Coastal Erosion: A Case Study of McFaddin Beach, Texas*. 2 vols. Minerals Management Service, U.S. Department of the Interior.

Suárez, Rafael
2019 Early Human Occupation in the Southeastern Plains of South America. In *People and Culture in Ice Age Americas: New Dimensions in Paleoamerican Archaeology*, edited by Rafael Suárez and Ciprian F. Ardelean, 52–66. University of Utah Press, Salt Lake City.

Suárez, Rafael, and Ciprian F. Ardelean
2019 Preface: An Upside-Down View. In *People and Culture in Ice Age Americas: New Dimensions in Paleoamerican Archaeology*, edited by Rafael Suárez and Ciprian F. Ardelean, xii–xvii. University of Utah Press, Salt Lake City.

Suhm, D. A., Alex D. Krieger, and Edward B. Jelks
1954 *An Introductory Handbook of Texas Archeology*. Bulletin of the Texas Archeological Society, vol. 25.

Suhm, D. A., and E. B. Jelks
1962 *Handbook of Texas Archeology: Type Descriptions*. Special Publication no. 1, Texas Archeological Society, and Bulletin no. 4, Texas Memorial Museum, Austin.

Suter, J. R., and H. L. Berryhill
1985 Late Quaternary Shelf-Margin Deltas, Northwest Gulf of Mexico. *AAPG Bull.* 69:77–91.

Swanton, John R.
1907 Mythology of the Indians of Louisiana and the Texas Coast. *Journal of American Folklore* 20:285–290.
1911 *Indian Tribes of the Lower Mississippi Valley and Adjacent Coast of the Gulf of Mexico*. Bulletin 43, Bureau of American Ethnology, Washington, DC.
1919 *A Structural and Lexical Comparison of the Tunica, Chitimacha, and Atakapa Languages*. Bulletin 68, Bureau of American Ethnology, Washington, DC.
1946 *Indians of the Southeastern United States*. Bulletin 137, Bureau of American Ethnology, Washington, DC.
1952 *The Indian Tribes of North America*. Bulletin 145, Bureau of American Ethnology, Washington, DC.

Sweet, William V., Robert E. Koop, Christopher P. Weaver, Jayantha Obeysekera, Radley M. Horton, E. Robert Theiler, and Chris Zervas
2017 *Global and Regional Sea Level Rise Scenarios for the United States*. Technical Report NOS CO-OPS 083, National Oceanic and Atmospheric Administration.

Taylor, Matthew S., and Susan Dial
2019 Caplen Mound. *Texas Beyond History*, https://texasbeyondhistory.net/coast/images/ap4

Taylor, Anna J., Cheryl L. Highley, Frank A. Weir, and Thomas R. Hester
1995 Archeological Investigations at the Loma Sandia Site (41LK28): A Prehistoric Cemetery and Campsite in Live Oak County, Texas. Studies in Archeology 20, Texas Archeological Research Laboratory, University of Texas at Austin.

Taylor, R. E.
1987 *Radiocarbon Dating*. Academic Press, London.

Texas Bureau of Economic Geology
2000 *Vegetation/Cover Types of Texas* (map), Perry-Casteñeda Map Collection, University of Texas, Austin

Texas Parks and Wildlife Department
2019a White-Tailed Deer (fact sheet), http://www.texasthestateofwater.org/screening/pdf_docs/fact_sheets/white-tailed_deer.pdf.
2019b The Rut in White-Tailed Deer, https://tpwd.texas.gov/huntwild/hunt/planning/rut_whitetailed_deer/#E11E2.

Tharp, James, and John Chapin
2004 Terminal Late Archaic Glacial Kame and Its Meadowood Phase. *Central States Archaeological Journal* 51(1):41–54.

Thayer, P. A., A. La Rocque, and J. W. Tunnell Jr.
1974 Relict Lacustrine Sediments on the Inner Continental Shelf, Southeast Texas. *Transactions of the Gulf Coast Association of Geological Societies* 24:337–347.

Thomas, Cyrus
1891 *Report on the Mound Explorations of the Bureau of Ethnology*. Smithsonian Institution, Bureau of Ethnology,

Twelfth Annual Report, Washington, DC.

Timberlake, H., D. H. King, and M. C. Indian
1765 *The Memoirs of Lt. Henry Timberlake: The Story of a Soldier, Adventurer, and Emissary to the Cherokees, 1756–1765*. Museum of the Cherokee Indian Press. As quoted by Speck, 1938.

*Times of Acadiana*
2007 Atakapas ~~Cajun~~ Country: How One Tribe May Rewrite Louisiana History. *Times of Acadiana* (Lafayette), vol. 27, no. 2, July 25, 2007.

Todd, David, and Jonathan Ogren
2016 *The Texas Landscape Project*. Texas A&M University Press, College Station.

Toomey, Richard S.
1993 Late Pleistocene and Holocene Faunal and Environmental Changes at Hall's Cave, Kerr County, Texas. Unpublished PhD dissertation, University of Texas at Austin.

Törnqvist, T. E., S. J. Bick, J. L. González, K. Van der Borg, and A. F. M. De Jong, A.F.M.
2004a Tracking the Sea-Level Signature of the 8.2 ka Cooling Event: New Constraints from the Mississippi Delta. *Geophys. Res. Lett.* 31, L23309.

Törnqvist, T. E., J, L. González, L. A. Newsom, K. Van der Borg, A. F. M. De Jong, and C. W. Kurnik
2004b Deciphering Holocene Sea-Level History on the U.S. Gulf Coast: A High Resolution Record from the Mississippi Delta. *Geol. Soc. Am. Bull.* 116:1026–1039.

Törnqvist, T. E., S. J. Bick, K. Van der Borg, K., and A. F. M. De Jong
2006 How stable is the Mississippi Delta? Geology 34, 697–700.

Toth, Edward Alan
1988 *Early Marksville Phases in the Lower Mississippi Valley: A Study of Culture Contact Dynamics*. Archeological Report no. 11, Mississippi Department of Archives and History.

Tunnell, J.W. Jr., and B. D. Causey
1969 Vertebrate Pleistocene Fossils from the Continental Shelf, Northwestern Gulf of Mexico. *Texas A&I University Studies* 2:75—76.

Turner, Ellen Sue and Thomas R. Hester
1985 *Field Guide to Stone Artifacts of Texas Indians*. Texas Monthly Press, Austin.

Turner, Ellen S., and Paul Tanner
1994 The McFaddin Beach Site on the Upper Texas Coast. *Bulletin of the Texas Archeological Society* 65:319–336.

Turner, Ellen S., Thomas R. Hester, and Richard L. McReynolds
2011 *Stone Artifacts of Texas Indians*. Taylor Trade Publishing, New York.

United States Geological Survey
2012 *Glaciers and Sea Level*. U.S. Geological Survey, U.S. Department of the Interior, May 30, 2012. Archived from the original on January 4, 2017.
n.d. Texas Geology Map Viewer. www.usgs.gov/centers/ot-water/science/texas-geology-web-map-viewer

University of Arizona
2018 Native Americans Shaped Prairie by Hunting Bison with Fire. *Futurity*, www.futurity.org, July 26, 2018.

University of Texas at Arlington
2019 Border Land: The Struggle for Texas, 1820–1879. https://library.uta.edu/borderland/period/texas-revolution-1835-36.

Urista, Juan Carlos
2009 Stratigraphy and Geochronology of the Vernor Mammoth Site, Brazoria County, Texas. Unpublished Master's thesis, Texas A&M University, College Station.

Van der Donck, Adrian
1846 *A Description of the New Netherlands*. Reprint, 1968, Syracuse University Press, New York Historical Society Coll. ser. 2, vol. 1, pp. 125–242.

Vehik, Rain
1982 Phase II Archeological Investigsations at Clayton Lake, Southeast Oklahoma. Research Series no. 8, University of Oklahoma, Norman.

Venter, O., E. W. Sanderson, A. Magrach, J. R. Allan, J. Beher, K. R. Jones, H. P. Possingham, W. F. Laurance, P. Wood, B. M. Fekete, M. A. Levy, and J. E. Watson
2016 *Global Terrestrial Human Footprint Maps for 1993 and 2009*. Scientific Data 3:160067.
2018 *Last of the Wild Project, Version 3 (LWP-3): 2009 Human Footprint, 2018 Release* (data set). NASA Socioeconomic Data and Applications Center (SEDAC), Palisades, New York. https://doi.org/10.7927/H46T0JQ4.

Vernon, Carol R.
1989 *The Prehistoric Skeletal Remains from the Crestmont Site, Wharton County, Texas*. Texas Archeological Research Laboratory, Austin.

Vogelin, Erminie W.
1942 Shawnee Musical Instruments. *American Anthropologist*, July–September 1942, pp. 463–475.

von Deimling, Thomas Schneider, Andrey Ganopolski, Hermann Held, and Stefan Rahmstorf
2006 How Cold was the Last Glacial Maximum? *Geophysical Research Letters* 33(14):1–5.

Vollset, Stein Emil, Emily Goren, Chun-Wei Yuan, Jackie Cao, Amanda E Smith, Thomas Hsiao, Catherine Bisignano, Gulrez S Azhar, Emma Castro, Julian Chalek, Andrew J Dolgert, Tahvi Frank, Kai Fukutaki, Simon I Hay, Rafael Lozano, Ali H Mokdad, Vishnu Nandakumar, Maxwell Pierce, Martin Pletcher, Toshana Robalik, Krista M Steuben, Han Yong Wunrow, Bianca S Zlavog, Christopher J L Murray
2020 Fertility, mortality, migration, and population scenarios for 195 countries and territories from 2017 to 2100: a forecasting analysis for the Global Burden of Disease Study. *The Lancet*, 2020; DOI: 10.1016/S0140-6736(20)30677-2.

Wagner, Frank
1967 *The Spanish Southwest, 1542–1794*. 1937, Quivira Society; reprint, Arno Press, New York.

Wagner, Frank, and William Carroll
1983 *Béranger's Discovery of Aransas Pass* (translation). Occasional Papers 8, Friends of the Corpus Christi Museum, Corpus Christi, Texas.

Walker, W. M.
*1934* A Variety of Pottery from Louisiana. *Journal of the Washington Academy of Sciences* 24(2):99–104.

Wallace, D. J., and J. B. Anderson
2013 Unprecedented Erosion of the Upper Texas Coast: Response to Accelerated Sea-Level Rise and Hurricane Impacts. *Geological Society of America Bulletin*, doi: 10.1130/B30725.

Walley, Raymond
1955 A Preliminary Report on the Albert George Site in Fort Bend County. *Bulletin of the Texas Archeological Society* 26:218–234.

Waters, M. R., S. L. Forman, T. A. Jennings, L. C. Nordt, S. G. Driese, J. M. Feinberg, J. L. Keene, J. Halligan, A. Lindquist, J. Pierson, C. T. Hallmark, M. B. Collins, and J. E. Wiederhold
2011 The Buttermilk Creek Complex and the Origins of Clovis at the Debra L. Friedkin Site, Texas. *Science* 331:1599–1603.

Waters, Michael R., Joshua L. Keene, Steven L. Forman, Elton R. Prewitt, David L. Carlson, and James E. Wiederhold
2018 Pre-Clovis Projectile Points at the Debra L. Friedkin Site, Texas: Implications for the Late Pleistocene Peopling of the Americas. *Science Advances* 4:6–13.

Waters, M. R., and T. W. Stafford Jr.
2007 Redefining the Age of Clovis: Implications for the Peopling of the Americas. *Science* 315:1122–1126.
2014 The First Americans: A Review of the Evidence for the Late-Pleistocene Peopling of the Americas. In *Paleoamerican Odyssey*, edited by K. E. Graf, C. V. Ketron, and M. R. Waters, 541–560. Texas A&M University Press, College Station.

Webb, Clarence H.
1968 The Extent and Content of Poverty Point Culture. *American Antiquity* 33(3):297–321.

Webb, William S.
1946 *Indian Knoll, Ohio County, Kentucky*. Publications of the Department of Anthropology and Archeology, vol. 4, no. 3, parts 1 and 2. University of Kentucky, Arlington.

Weddle, Robert S.
1985 *Spanish Sea: The Gulf of Mexico in North American Discovery, 1500–1685.* Texas A&M University Press, College Station.
1987 *La Salle, the Mississippi, and the Gulf: Three Primary Documents*. Texas A&M University Press, College Station.
1991 *The French Thorn: Rival Explorers in the Spanish Sea, 1682–1762.* Texas A&M University Press, College Station.
1995 *Changing Tides: Twilight and Dawn in the Spanish Sea, 1763–1803*. Texas A&M University Press, College Station.

Wellner, J. S., S. Sarzalejo, M. Logoe, and J. B. Anderson
2004 The Late Quaternary Stratigraphic Evolution of the West Louisiana–East Texas Continental Shelf. In *Late Quaternary Stratigraphic Evolution of the Northern Gulf of Mexico Margin*, edited by J. B. Anderson and R. H. Fillon, 217–236. Special Publication 79, Society for Sedimentary Geology.

Wheat, Joe Ben
1953 An Archeological Survey of the Addicks Dam Basin, Southeast Texas. River Basins Survey no. 4. Smithsonian Institution, *Bureau of American Ethnology Bulletin*154(4):143–252.
1967 A Paleo-Indian Bison Kill. *Scientific American* 216:44–52.

White, Nancy Marie, and Richard A. Weinstein
2008 The Mexican Connection and the Far West of the U.S. Southeast. *American Antiquity*, 73(2):227–277.

Wilbarger, John Wesley
1890 *Indian Depredations in Texas: Reliable Accounts of Battles, Wars, Adventures, Forays, Murders, Massacres, etc., Together with Biographical Sketches of Many of the Most Noted Indian Fighters and Frontiersmen of Texas.* Hutchings Printing House, Austin.

Wilhelm, Kerri
2015 A Masterpiece in Stone. TARL Blog, Texas Archeological Research Laboratory, March 17, 2015, www.sites.utexas.edu/tarl.

Willey, Gordon R., and Philip Phillips
1957 *Method and Theory in American Archaeology*. University of Chicago Press.

Williams, Thomas J., Michael B. Collins, Kathleen Rodrigues, William Jack Rink, Nancy Velchoff, Amanda Keen-Zebert, Anastasia Gilmer, Charles D. Frederick, Sergio J. Ayala, and Elton R. Prewitt
2018 Evidence of an Early Projectile Point Technology in North America at the Gault Site, Texas, USA. *Science Advances*, July 14, 2018, 4:1-7, http://advances.sciencemag.org/content/4/7/eaar5954.

Williams, Thomas J., and David B. Madsen
2019 The Upper Paleolithic of the Americas. *PaleoAmerica Journal* (online), May 17, 2019.

Williams, Thomas J., Nancy Velchoff, Michael B. Collins, and Bruce A. Bradley
2019 Stone Tool Technology at the Gault site: Exploring Technology, Patterns, and the Early Human Occupation of North America. In *People and Culture in Ice Age Americas*, edited by Rafael Suarez and Ciprian F. Ardelan, 134–155. University of Utah Press, Salt Lake City.

Wilson, Barry Tyler, Christopher W. Woodall, and Douglas M. Griffith
2013 Forest Carbon Stocks of the Contiguous United States (2000–2009). U.S. Department of Agriculture, Forest Service, Northern Research Station, Newtown Square, PA. https://doi.org/10.2737/RDS-2013-0004.

Winker, Charles D.
1979 Late Pleistocene Fluvial-Deltaic Deposition, Texas Coastal Plain and Shelf. Unpublished Master's thesis, University of Texas at Austin.
1990 Evidence for Late Pleistocene High-Stand Paleogeography of Texas Coastal Plain and Subsequent Warping of the Strandline. Map D of Plate 8 in *Quaternary Nonglacial Geology, Conterminous U.S.*, vol. K-2, *The Geology of North America*. Geological Society of America.
1991 The Northwestern Gulf Coastal Plain. In J. R. Dubar, Thos. E. Ewing, E. L. Lundelius, D. G. Otvos, and Charles D. Winker, Quaternary Geology of the Gulf of Mexico Coastal Plain, chap. 19, pp. 583–610, vol. K-2, in *The Geology of*

*North America*, Geological Society of America.

1996 High Resolution Seismic Stratigraphy of a Late Pleistocene Submarine Fan Ponded by Salt-Withdrawal Mini-Basins on the Gulf of Mexico Continental Slope. *Offshore Technology Conference Proceedings*, May 1996, OTC 8024, pp. 619–628.

Winker, C. D, and J. R. Booth

2000 Sedimentary Dynamics of the Salt-Dominated Continental Slope, Gulf of Mexico: Integration of Observations from the Seafloor, Near Surface and Deep Subsurface. In *Deep-Water Reservoirs of the World*, edited by P. Weimer, R. M. Slatt, J. Coleman, N. C. Rosen, H. Nelson, A. H. Bouma, M. J. Styzen, and D. T. Lawrence. Gulf Coast Section, SEPM 20th Annual Research Conference, CD-ROM, pp. 1059–1086.

Winship, George Parker

1896 *The Coronado Expedition, 1540–1542*. Government Printing Office, Washington, DC.

Wintemberg, W. J.

1908 The Use of Shells by the Ontario Indians. In *Annual Archaeological Report of the Provincial Museum and Art Gallery of Ontario*. Ontario Archaeological Museum, Toronto.

Wissler, Clark

1920 *North American Indians of the Plains*. American Museum of Natural History Anthropological Handbook, no. 1.

1966 *Indians of the United States*. Revised second edition, Doubleday, New York.

Wolf, George E. Jr.

1992 The Pleistocene of Harris County, Texas, Pasadena, Texas. Unpublished notes.

2011a *Pleistocene Fossils of White Oak Bayou.* Privately published, Houston. Available at MagCloud.com.

2011b *Upper Armand Bayou Fossil Fauna*. Privately published, Houston. Available at MagCloud.com.

2011c *The Fossils of Sims Bayou*. Privately published, Houston. Available at MagCloud.com.

2011d *Pleistocene Fossils of the Texas City Dike*. Privately published, Houston. Available at MagCloud.com.

Wong, Corinne I., Jay L. Banner, and MaryLynn Musgrove

2015 Holocene Climate Variability in Texas, USA: An Integration of Existing Paleoclimate Data and Modeling with a New, High-Resolution Speleothem Record. *Quaternary Science Reviews* 127: 155–173.

Woodman, David Jr.

1835 *Guide to Texas Emigrants*. M. Hawes, Boston.

Woodrick, James V.

2009 *Elusive Dreams: Early Exploration and Colonization of the Upper Texas Coast*: Liberty County Historical Commission, Kemp and Company, Houston.

2017 Texas History Snippets Interactive Map: Roads and Places of the Texas Revolution. https://www.teachingtexas.org/resources/texas-history-snippets-interactive-map-roads-and-places-texas-revolution.

2018 Santa Rosa del Alcázar. *Handbook of Texas Online*, http://www.tshaonline.org/handbook/online/articles/hvsra, accessed August 30, 2019.

2020 Tayovayas: From Quivera to the Red River. Texas History Snippets, www.texashistorysnippets.blogspot.com.

Worrall, Dan M.

2016 *Pleasant Bend: Upper Buffalo Bayou and the San Felipe Trail in the Nineteenth Century*: Concertina Press, Fulshear, Texas.

Wreschner, Ernst E.

1980 Red Ochre and Human Evolution: A Case for Discussion. *Current Anthropology* 21:631–644.

Wyckoff, Don G.

1968 *The Bell and Gregory Sites: Archeological Chronicles of Prehistory in the Pine Creek Reservoir Area, Southeast Oklahoma*. Archaeological Site Report 11, University of Oklahoma Research Institute, Norman.

1980 Caddoan Adaptive Strategies in the Arkansas Basin, Eastern Oklahoma. Unpublished PhD dissertation, Anthropology, Washington State University, Pullman.

1984 The Foragers: Eastern Oklahoma. In *Prehistory of Oklahoma*, edited by R. E. Bell. 119–160. Academic Press, New York.

1995 A Summary of the Calf Creek Horizon in Oklahoma. *Bulletin of the Oklahoma Anthropological Society* 42:179–210.

Yancey, Thomas E.

1995 Depositional Environments and Stratigraphy of Late Eocene Sediments, East-Central Texas. U.S. Geological Survey Publications of 1995, https://pubs.usgs.gov/of/1995/of95-595/INTRO.htm.

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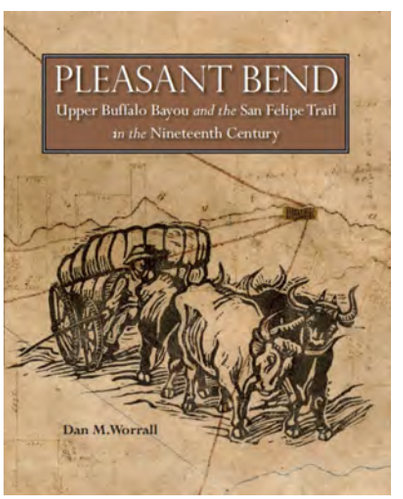
# About the Author

Dan Michael Worrall is one of a fifth generation of his family to live in the Houston area. Trained in regional geology, he retired from a career in petroleum exploration research and management. He holds a bachelor's degree from Rice University, a master of arts from the University of Wyoming, and a PhD from the University of Texas at Austin, all in geology, as well as a masters in teaching from Northwestern. He served on the Harris County Historical Commission from 2014 to 2023, and worked on a project to bring historical markers to significant sites in western Harris County. He led an effort to save the pioneer Morse-Bragg Cemetery in Houston from destruction, and it is now a Harris County park. In 2016 he published a history of the early settlers of the western part of Greater Houston, entitled *Pleasant Bend: Upper Buffalo Bayou and the San Felipe Trail in the Nineteenth Century.*

Curious about the world of the earliest residents of his native Houston area, he joined the Houston Archeological Society and began to research and compile digital records from hundreds of archeological sites. At the same time, he worked with geologist John Anderson at Rice University and geophysicists at Compagnie Générale de Géophysique in Houston to create a map record of the gradual inundation of our area by rising sea level since the last global glaciation. He integrated all of this archeological, geological, and historical information into a series of regional maps, and this book is the result of that research.

He has also published a number of works on the social history of the Anglo concertina, a Victorian era musical instrument that remains popular today in Irish, English and American traditional music.

He lives with his wife on a farm in the lower Brazos valley just west of Fulshear, near one of the outstanding archeological sites in the region. They have two grown children and three grandchildren.



Houston and Southeast Texas have an ancient, storied past. This region's earliest people were living here as Texas emerged from the cooler climate of the last ice age. Rising seas were an ever-present threat along the coast; sea level eventually rose over 400 feet and swallowed huge parts of their coastal habitat. They lived on shellfish from the bays as well as on alligator, turtles, and catfish from the rivers. They migrated inland during the cool months, hunting bison on the Katy and San Bernard prairies millennia before Spanish horses arrived. They shaped the prairies with fire, using it to move animals to kill sites. They traded goods, technology and ideas with people from as far away as the Ouachita Mountains, Mississippi and Ohio river valleys, and Great Lakes. They lived sustainably on this land for well over 13,000 years, before being felled by European disease and colonization. They were known to the Spanish and French as the Akokisa, Bidais, and Coco. With data from hundreds of archeological site reports, a coastal landscape modeled through time in 3D, and digital GIS mapping to weave it all together, this is their story.

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